Housing, Health, and the Well-Being of Children

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Disclaimer

The views and interpretations in this report are those of the researchers and not the official position of the Ministry of Social Development or Te Tūāpapa Kura Kāinga – the Ministry of Housing and Urban Development.

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Executive summary

The World Health Organisation (WHO) recently published housing and health guidelines recommending that household crowding be reduced, that 18°C is a minimum safe indoor temperature during cold seasons to protect health, and that persistent dampness and microbial growth in homes be avoided or minimised. These recommendations are based on the strength of the evidence linking health problems to exposure to these conditions.

There are well-established links between exposure to poor housing conditions and adverse health outcomes. (Baker et al., 2013; Fisk et al., 2007, 2010; Institute of Medicine (US) Committee on Damp Indoor Spaces and Health, 2004; Mark J. Mendell et al., 2011; WHO Regional Office for Europe, 2009; World Health Organization, 2018) These reviews have generally found that current evidence is sufficient to document an association between specific health outcomes and these housing conditions. For example, the evidence of an association between household crowding and gastroenteritis suggests with high certainty that reducing crowding would reduce the risk of the illness.(World Health Organization, 2018) In addition, current evidence suggests a strong association between indoor dampness and mould and a wide range of respiratory symptoms (World Health Organization, 2018), and for asthma exacerbation, the current evidence is strongly suggestive of a causal relationship (Mark J. Mendell et al., 2011).

For this report, we analysed data from the *Growing Up in New Zealand Longitudinal Study* to examine the relationship between specific housing conditions and health outcomes for children, mothers, and other household members. While the study covers mothers from the antenatal period until the children are six years old, we primarily focus on the 9-month survey results becasue this survey has the best measures of the housing conditions of interest and this is a time in children's lives when they are likely to spend much of it in the home.

This report adds to the existing literature by analysing the overlap in housing conditions and the relationship between multiple housing conditions and health outcomes. In general, we found that there is extensive overlap in these housing conditions – for example, 7% of children's homes were both damp and mouldy, which means that about one-third of damp homes were also mouldy, and more than random assignment of these conditions would suggest.[1] Household crowding was also found more frequently with these other housing conditions – 20% of children in crowded households lived in homes that were also damp and mouldy, whereas, only 5% of children in households that were not crowded lived

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[1] Using random assignment, 3% of homes were both damp and mouldy.

in homes that were damp and mouldy. Given these results, we used principal components analysis to develop an overall housing condition index that is positively correlated with our measures of damp, mould, and lack of heating in the home.

While there was overlap in these housing conditions, our regression results indicated that one housing condition tended to dominate a specific health outcome. For example, dampness in the baby's room was strongly and consistently associated with chest infections and with cough lasting more than a week in the first 9 months of children's lives. Still, the overall housing condition index also showed a significant, consistent association with our main health outcomes for children in the 9-month sample – cough lasting more than a week, chest infections, ear infections, skin infections, and gastroenteritis – which indicates that increasing the number of housing problems in children's homes also increases the odds of children having these health outcomes.

We also examined a limited number of health outcomes for mothers and other members of the child's household. There was a strong association between mould and mothers' general health. For other household members, we found a consistent and significant association between serious skin infections and most of the housing condition measures.

Our results suggest that children in low-income households and children living in rented homes were more likely to live with these housing conditions, which is consistent with previous research. However, it is surprising that there was a significant difference in the odds of living in these conditions for children with household incomes up to $100,000 (compared to children with household incomes of $150,000 or more). It is also surprising how much higher the odds were for children living in public rentals compared to those in private rentals and compared to those in owner-occupied homes. It is important to remember that these results correspond to the 2010/2011 time period and that efforts are underway to improve the condition of public rentals, and new regulations aim to improve the quality of both public and private rental properties.[2]

In our 9-month sample, our results show that these children had health conditions that have previously been associated with the housing conditions analysed -- almost half had a cough lasting at least a week and more than a quarter were reported to have a chest infection in their first 9 months. Most children with these illnesses also went to the doctor at least once and a fair proportion were hospitalised (close to twenty percent for chest infections). Moreover, a small percentage of children were hospitalised 4 or more times due to chest infections in the first 9 months of their lives.

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[2] All rental properties are expected to comply with the new regulations by 2024. Hence, we would expect different results if this analysis were run on a 2024 birth cohort.

These results suggest that policies aimed at reducing the risk of these housing-related health outcomes should take into account all of the problems in the home rather than focusing on a single problem. Moreover, our results suggest that these problems are not limited only to the lowest income households but that even children in middle income households have an increased risk of living in these conditions.

Introduction

In New Zealand, housing is problematic on a number of fronts. First, dampness, cold, and mould are common in both owner-occupied and rental dwellings, though evidence suggests that rentals are generally in worse condition than owner-occupied properties. (Statistics New Zealand, 2015; White et al., 2015; White & Jones, 2017) In 2018/19, 34% of New Zealanders report that their homes are sometimes or always damp and 36% report that their homes are mouldy (with 45% of these respondents reporting that the mould is sometimes or always larger than a sheet of A4 paper). Moreover, 21% of New Zealanders report that their homes are always or often colder than they like, and another 29% report their homes are sometimes colder than they like in winter. For those who tend not to heat rooms in their homes at night in winter, a substantial portion attribute the reason for not doing so to cost. (Statistics New Zealand, 2019a)

Second, New Zealand households spent more of their disposable income on housing in 2017 than any other OECD country – 26% of their disposable income on average. (Carey & Barker, 2017) Moreover, growth in real house prices has far outpaced the OECD average. (OECD, 2020) High housing costs generally compound these problems as people may not be able to afford to heat their homes, undertake repairs, or purchase their own homes. In fact, 19% of people reported costs as a main reason for not heating their youngest child's room, and 61% of homeowners whose homes required moderate or major repairs reported costs as a main reason for not repairing them. (Statistics New Zealand, 2019a) As New Zealanders shift towards renting (from approximately one-quarter to more than one-third of the population between 1986 and 2017), it is expected that more of the population will be exposed to potentially harmful home environments. Almost half of renters (47%) reported mould in their home compared to almost a third of homeowners (30%). Similar numbers are seen for reports of the home always or sometimes being damp (49% of renters and 27% of homeowners). Renters are also almost twice as likely to report that their home needs major repairs than owners (6% of renters versus 3% of owners). (Statistics New Zealand, 2019a)

The problems of housing affordability, crowding, and quality also tend to disproportionately impact low-income households. The lowest household income quintile spent 54% of their income on housing in 2015 (Carey & Barker, 2017), and still 15% of these households live in crowded conditions compared to 2% of households in the highest income quintile. (Ministry of Health, 2014) In addition, 53% of households with total household income of $20,000 or less reported that they did not own the dwelling in which they lived, whereas the same was true for only 20% of households with total income of $100,000 or more. With rental properties generally being in worse condition than owner-occupied properties, lower income households are then more likely to be living in lower quality accommodation. When these housing conditions lead to health problems, those living in these households are generally forced to miss work or school.

A number of meta-analyses and systematic reviews have been conducted about the association between health outcomes and the housing conditions being studied in this report. (Baker et al., 2013; Fisk et al., 2007, 2010; Institute of Medicine (US) Committee on Damp Indoor Spaces and Health, 2004; Mark J. Mendell et al., 2011; WHO Regional Office for Europe, 2009; World Health Organization, 2018) These reviews have generally found that current evidence is sufficient to document an association between specific health outcomes and these housing conditions. For example, the evidence of an association between household crowding and gastroenteritis suggests with high certainty that reducing crowding would reduce the risk of the illness. In addition, current evidence suggests a strong association between indoor dampness and mould and a wide range of respiratory symptoms[3] (World Health Organization, 2018), and for asthma exacerbation, the current evidence is strongly suggestive of a causal relationship (Mark J. Mendell et al., 2011).

For this report, we analysed data from the *Growing Up in New Zealand* Longitudinal Study to examine the relationship between specific housing conditions and health outcomes for children, mothers, and other household members. While the study covers mothers from the antenatal period until these children are six years old, we primarily focus on the 9-month survey results since this survey has the best measures of the housing conditions of interest and this is a time in children's lives when they are likely to spend much of it in the home.

This report adds to the existing literature by analysing the overlap in housing conditions and the relationship between multiple housing conditions and health outcomes. In general, we found that there is extensive overlap in these housing conditions. For example, 7% of children's homes were both damp and mouldy, which means that about one-third of damp homes were also mouldy – more

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[3] There is strong evidence that exposure to dampness and mould in young children leads to development of asthma in these children. (Kusel et al., 2007).

than random assignment of these conditions would suggest.[4] Household crowding is also found more frequently with these other housing conditions – 20% of children in crowded households lived in homes that were also damp and mouldy, whereas, only 5% of children in households that were not crowded lived in homes that were damp and mouldy. Given these results, we used principal components analysis to develop an overall housing condition index that is positively correlated with our measures of damp, mould, and lack of heating in the home.

While there is overlap in these housing conditions, our regression results indicate that one housing condition tended to dominate a specific health outcome. For example, dampness in the baby's room was strongly and consistently associated with chest infections and with cough lasting more than a week in the first 9 months of children's lives. Still, the overall housing condition index also showed a significant, consistent association with our main health outcomes for children in the 9-month sample – cough lasting more than a week, chest infections, ear infections, skin infections, and gastroenteritis – which indicates that increasing the number of housing problems in children's homes also increased the odds of children having these health outcomes.

Moreover, most research on housing-related health outcomes in New Zealand is based on hospitalisations, but we are able to look beyond hospitalisations to assess the number of times children had these illnesses, went to the doctor for these illnesses, and were hospitalised for these illnesses which allows us to better understand the number of community cases in these children as well as their rate of medical care utilisation.

The report is organised as follows. The first section describes the data and methods used in the analysis. The second section describes the results of the analysis beginning with a description of the sample used, including summary statistics for the children, their mothers, and their households. This section next describes the housing conditions, health outcomes, and the relationships between these for this sample of children and their families. The report concludes with a discussion of the results, limitations, and future directions for research.

Method

The *Growing Up in New Zealand* Data

We used the data collected within *Growing Up in New Zealand*, a child cohort study covering children antenatally until they were six years old. Pregnant

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[4] Using random assignment, 3% of homes were both damp and mouldy.

women were eligible for the study if their estimated delivery date was between 25 April 2009 and 25 March 2010, and they resided within three contiguous District Health Board (DHB) regions in the northern part of the North Island (Auckland, Waikato, and Counties-Manukau DHBs). Morton et al. (2015) provide more detailed information about the study design and sample.

For this study, we used three waves of data to varying degrees. These included the following:

- Antenatal wave: survey of mother and mother's partner primarily conducted in 2009/2010;
- 9-month wave: survey of mother and mother's partner primarily conducted in 2010/2011, with the mother being the main proxy for questions about the child;
- 2-year wave: survey of mother, mother's partner, and child's proxy conducted primarily in 2011/2012.

We primarily used information from the 9-month survey as that had the best measures of housing conditions for our analysis, allowed us to use the full sample, and was a time in the children's lives when they tend to spend a substantial portion of their time in the home. We also used health outcome measures from the 2-year survey but were limited to only those children that did not move between the 9-month and 2-year surveys. This not only is a much smaller sample but is likely to be a selected sample of children.

Housing Measures

For this report, we focused on the unsafe and substandard housing conditions in the *WHO Housing and health guidelines* that are most relevant for New Zealand. (World Health Organization, 2018) Based on systematic reviews of the scientific evidence, these guidelines recommend that household crowding be reduced, that 18°C is a minimum safe indoor temperature during cold seasons to protect health and that persistent dampness and microbial growth in homes be avoided or minimised. (World Health Organization, 2018) The WHO guidelines make these recommendations based on the strength of the evidence linking health problems to exposure to these conditions. For this project, we focus on housing conditions inside homes that are typically associated with poorer health outcomes in New Zealand: household crowding, cold temperatures, dampness, and mould.

For household crowding, our main measure of crowding is based on the number of household members per bedroom. Tin Tin et al. (2016) used the same basis for their measure, with 2 or more people per bedroom defining a higher level of crowding. We used the number of people per bedroom as both a continuous measure and an indicator of when a household is considered crowded. When using this measure as an indicator variable, we use two different thresholds: 1)

2 or more people per bedroom and 2) more than 2 people per bedroom. These measures are complicated by the top-coding of both the number of bedrooms in the home and the number of people in the household, with top-codes varying across waves. Hence, we also construct our measures without observations that were top-coded.

In New Zealand, the standard household crowding measure is based on the Canadian National Occupancy Standard (CNOS), which uses the age and gender of household members to determine the number of bedrooms needed for the household. (Goodyear et al., 2011) Under this standard, no more than two people should share a bedroom regardless of age or gender[5], a household with a one-bedroom deficit is considered crowded, and a two-bedroom deficit is considered severely crowded. In the data available for this project, we did not have the information to construct this measure, and the number of people per bedroom is the most consistent measure we can use across waves.

However, we do not expect these measures to affect our estimates given that Goodyear et al. (2011) report that different measures of crowding do not substantially impact the proportion of households considered to be crowded. Moreover, Torshizian and Grimes (2020) find that three measures of household crowding – perceived crowding, people per bedroom, and the CNOS – were all valid measures of household crowding when assessing housing stress.

To assess the prevalence of conditions pertaining to the interior environment of the home, we estimated the proportion of households that are cold, damp, or mouldy as well as the proportion of households where children are likely to be exposed to second-hand smoke either from the mother, the mother's partner or others in the household. While second-hand smoke is not necessarily a condition related to the dwelling itself, it has been associated with health problems and will be used as a control. Questions about smoking were asked of the mother in the antenatal, 9-month, and 24-month. Questions about smoking were asked of the partner in the antenatal, 9-month, and 24-month surveys. Questions about others smoking in the household and in the same room as the child were asked of the mother and her partner in the 9-month and 24-month surveys.

For the interior environment, we focused on indicators of cold (house overall and child's bedroom), damp, mould/mildew. The best measures of these conditions were available only in the 9-month. For our indicators of a cold home, we used three questions from the mothers' 9-month survey: 1) 'do you heat your house?', 2) 'what forms of heating do you use in the room where your baby sleeps at night? No heating', and 3) 'in the last 12 months have you personally put up with feeling cold to save heating costs?' Finally, we estimated the

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[5] This seems counter to advice provided by the Ministry of Health that babies should sleep in the same room as their caregiver for the first six months. (Ministry of Health, 2020)

calendar month of the interview since we would expect answers to vary between winter and summer months.

For indicators of a damp or mouldy home, we used responses related to the three questions from the mother's 9-month survey: how often the house where the child lives most is damp (5-pt scale), how often there is heavy condensation in the room where the child sleeps at night (5-pt scale), whether or not there has been mould or mildew in the room where the child sleeps at night in the last 2 weeks (yes/no). Unfortunately, these questions were only asked at 9 months, so we cannot examine changes of these over time.

Using the indicators of houses being crowded, cold, damp, or mouldy, we estimated the proportion of homes with these conditions. We also estimated the proportion of children whose bedrooms were reported as cold, damp, or mouldy. While we estimated these conditions separately, we know that they are often found together. For example, it is well known that cold indoor temperatures lead to problems with dampness and condensation (Pollard, 2018), which in turn, generally lead to problems with mould and mildew. Hence, we estimated the likelihood that these conditions are found jointly in various combinations (e.g., cold and damp; damp and mouldy; cold, damp, and mouldy).

After developing our indicators for these different categories of housing conditions, we assessed the frequency with which these different types of conditions occurred in the same homes. For example, we expect that more crowded homes are more likely to have problems with damp and mould, but we have not seen any research that looks at this in detail.

Given the number of questions related to some of these conditions and the relationship between the factors themselves, we used a principal components analysis to determine which variables are in fact measuring the same underlying factors and if indices can be developed (which are by design orthogonal to each other) as stronger measures for these conditions.

Health Measures

For the housing-related health problems, we looked at those health problems that have been previously associated with our poor housing conditions in the literature, and we have conducted an extensive literature review to determine which health problems have been associated with these poor conditions. (Baker et al., 2013; Fisk et al., 2007, 2010; Mark J. Mendell et al., 2011; World Health Organization, 2018)

The health outcomes to be examined include the following:

- at 9 months: ear infection; chest infection, wheezing, bronchiolitis, bronchitis, asthma, pneumonia, croup; cough lasting for a week or more; gastroenteritis; skin infection[6];
- at 24 months: ear infections; chest infections, bronchiolitis, bronchitis, pneumonia, croup; cough in the last 4 weeks; wheezing in chest; and gastroenteritis.

Using these health outcomes, we estimated the proportion of children with these conditions. Further, we produced descriptive statistics about the reported severity and medical utilisation of children with these conditions, including the number of times children had the health issue, saw a medical professional, were hospitalized, and treatments provided to the child (generally available at 9 months and 24 months). However, the number of times a child had the health issue, saw a doctor, and were hospitalised are not continuous variables but categorical variables. The categories also are not consistent within waves (e.g., the categories for doctor's visits for ear infections are different than those for gastrointestinal illnesses in the 9-month survey). This makes aggregating these measures problematic.

Some of these health outcomes are vaccine preventable (e.g., whooping cough/pertussis) – the 9-month survey asks whether or not the child was vaccinated at birth, at 6 weeks, at 3 months, at 5 months, and not vaccinated at 9 months.[7] There is also an indicator measure for whether the 6-week, 3-month, and 5-month were all given on time, which was developed from administrative records in the National Immunisation Register linked to the GUiNZ child. We use these measures as controls in the analysis since being vaccinated decreases the likelihood of contracting some of the illnesses of interest.

Mothers were also asked about their own general health and specific health conditions in the early waves of the survey. In the antenatal survey, mothers were asked about their general health before their pregnancy (5-point scale) and if they were ever diagnosed with asthma by a doctor (mothers' responses were never, before current pregnancy but not during, before and during current pregnancy, only during current pregnancy). At 9 months, mothers were also asked about their own general health as well as whether they have had the

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[6] In the 9-month survey, a skin infection was further defined as where the skin is red and warm, or there are pustules or boils, or crusting or oozing.

[7] In NZ, the National Immunisation Schedule commencing 1 July 2011 indicates that vaccinations for diphtheria, tetanus, pertussis (whooping cough), polio, Hib, hepatitis B, pneumococcus, measles, mumps, and rubella should have been given at 6 weeks, 3 months, and 5 months. The schedule also indicates that, at birth, infants of HBsAg positive mothers should have been given hepatitis B immunoglobulin (HBIG) and hepatitis B vaccine, and that infants at increased risk of tuberculosis (TB) should have been offered Neonatal Bacillus Calmette-Guérin (BCG) vaccine. (Ministry of Health, 2011).)

following health problems: coughing on most days, pneumonia, asthma, eczema, and hay fever. We used these measures to assess the prevalence of these conditions in mothers. However, the questions about specific health problems (i.e., pneumonia, asthma, eczema, and hay fever) did not have a time frame, so presumably these questions are about ever having these conditions.

In the 9-month survey, mothers were also asked about the number of people in the household who have had skin infections in the last 3 months (excluding the child).

From a mental health perspective, we used questions from the antenatal, 9-month, and 2-year surveys posed to mothers and their partners about the extent to which housing difficulties (antenatal, 9-month, and 2-year surveys) are stressful and also about feelings of unfair treatment in the housing market whether buying or renting (antenatal survey only). To put the question about unfair treatment into perspective, we also examined feelings of unfair treatment in the job market (at work or refusal of a job), in obtaining credit (loans, mortgages, hire purchases or credit cards), and when obtaining medical services (treated differently or kept waiting by a health professional). These questions were posed for two time periods: more than 12 months ago and in the last 12 months. We combined the two time periods due to a small number of observations in some cases.

Explanatory Variables

In the antenatal wave, the person interviewed as the 'mother' is the biological mother, and the person interviewed as her partner is generally the biological father. However, in later waves, the person interviewed as the 'mother' is not necessarily the same person interviewed as the mother in the antenatal survey. Information about the biological mother was obtained in the antenatal wave; however, in the 9-month survey, there were very few mothers who were not the biological mother.[8] For the remainder of the report, we will simply refer to the 'mother' rather than differentiating between the biological mother and the mother responding to the survey.

Household

Annual household income is based on a categorical variable in the data set. We combined some of the original categories (e.g., 'less than $20,000' and '$20,000 to $30,000') when the number of respondents in the categories were much smaller than the numbers in other categories and initial regressions indicated

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[8] In robustness checks for the regressions, we used the sample of children where the biological mother was the mother interviewed at 9 months, and the results did not change.

similar outcomes for the two groups.[9] Moreover, the 24-month survey had finer income categories which we combined to match the 9-month survey income categories.

Housing tenure is another categorical variable which is derived from a number of questions asked of the mother about ownership of the dwelling, payment of rent, and payment of a mortgage by someone in the household. Moreover, responses to these questions in the second or third wave were only available if the mother reported moving since the last interview. So, for mothers reporting that they did not move, we used the housing tenure from the previous wave. For example, if mothers reported in the 9-month survey that they had not moved, we used the housing tenure information from the antenatal survey.

The housing tenure categories were not consistently coded, so we combined categories in some waves to make them consistent. For example, in the antenatal survey, we combined the categories 'Freehold', 'Own, paying mortgage', and 'Own, don't know' into one category – 'Own'. The final categories are 'Private Rental', 'Public Rental'[10], 'Other Rental', 'Own'.

We also created simple indicator variables for the household owning the house and for the household renting the house. It should be noted that the skip pattern for the survey was such that if the mother responded that someone in the household owned the house, then the question about someone paying rent in the household was not asked. This means that the housing tenure categories are at the household level and are not necessarily reflective of the mother's situation. For example, a mother renting a room in the house of an owner-occupier could be flagged as being in a home owned by someone in the household. In the antenatal survey, 6% of mothers report living with non-kin.

When available (9-month survey), we also used a continuous measure of the number of household members who smoke as well as an indicator of household members (excluding the mother) smoking.

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[9] In addition to income amounts, respondents were asked about the sources of household income (e.g., employment earnings, government benefits). The antenatal survey enumerates fourteen different sources of income while the 9-month survey enumerates sixteen different sources, though many of the categories are the same. We used principal components to combine sources into indices because it is not feasible to include all the different sources in a regression analysis with such a small number of observations and some sources of income may be highly correlated. The income measures also had a substantial number of missing values compared to the income source measures. We used these in initial regression analyses and found the results using the income source indices were similar to the income amounts, so we primarily focused on the income amounts as they are more interpretable.

[10] Public rentals include housing that is owned by a local authority or city council, Housing New Zealand (now Kāinga Ora), other state-owned corporation, state-owned enterprise, government department or ministry.

Child

For the child, we use some indicators of the health of the child at birth. We used the child's birthweight (in grams), gender, and age at the time of the survey (in months). We also used gestation age: PreTerm (less than 37 weeks), Term (37-41 weeks), and PostTerm (more than 41 weeks). It should be noted that the child's birthweight and the gestation age have a fairly high correlation (r=0.439). The child's age at the time of the survey (for the 9-month and 24-month surveys) and the birth month of the child are used to estimate the month of the interview since reports of the housing conditions (damp, mould, and heating) and children's health are likely to vary with the seasons. We used the interview month to create an indicator for winter interview month (interview in June, July, or August). As mentioned above, we also included indicators for the child's vaccination status.

In the study, some mothers gave birth to multiple children (e.g., twins), and for these children, we added a variable for the number of births but also have an indicator for a child who was a singleton. The average number of GUiNZ children born to the same mother was 1.03.

Mother

As mentioned previously, the person interviewed as the mother in later waves may not be the biological mother. So, when analysing a child's health outcomes, we used indicators of the biological mothers' health measures. These included pre-pregnancy BMI, a self-reported assessment of pre-pregnancy general health, age at the antenatal interview, and an indicator that the mother smoked during pregnancy.

Socioeconomic and demographic characteristics for the mother were also used. These included mothers' self-prioritised ethnicity (antenatal), highest qualification (antenatal), age at interview.

Regression Analysis

For binary dependent variables (e.g., whether the house is damp), we used logistic regressions with robust standard errors and coefficients reported as odds ratios. For categorical dependent variables counting number of events (e.g., number of times child had an illness, number of times child went to see the doctor), we used an ordered logistic regression with robust standard errors and coefficients reported as odds ratios. For counts of variables that are top-coded (e.g., number of respiratory hospitalisations, number of days in hospital for respiratory condition), we used a censored Poisson regression. For the continuous variables (e.g., housing condition index), we used Ordinary Least Squares with robust standard errors.

An odds ratio is a measure of association between an exposure (e.g., damp house) and an outcome (e.g., chest infection). The odds ratio is the chance that the outcome will occur given the exposure relative to the chance the outcome will occur in the absence of the exposure. The odds ratio is often written in terms of the number of cases (e.g., number of people with a chest infection) and non-cases (e.g., number of people without a chest infection) and their exposure (e.g., whether people live in damp houses):

$$OR = \frac{exposed\ cases / unexposed\ cases}{exposed\ non-cases / unexposed\ non-cases}$$

$$= \frac{exposed\ cases}{exposed\ non-cases} \frac{unexposed\ non-cases}{unexposed\ cases}$$

Hence, if the odds ratio is equal to one, the proportion of cases to non-cases is equal regardless of exposure:

$$\frac{unexposed\ cases}{unexposed\ non-cases} = \frac{exposed\ cases}{exposed\ non-cases}$$

Similarly, if the odds ratio is greater than one, then the exposure increases the likelihood or risk of the outcome. Conversely, if the odds ratio is less than one, then the exposure reduces the likelihood or risk of the outcome. Hence, in the regression analyses, the null hypothesis is that the odds ratio is equal to one.

Results

Summary Statistics for the Sample

The summary statistics for this sample are shown in Table 1. In the sample of children from the 9-month survey, 52% were male[11], most were singletons, with an average age of 39 weeks at the time of the survey 91% were born at term (37-41 weeks of gestation), and 6 percent were pre-term (less than 37 weeks). Most of the children were reported as receiving their 6-week (95%), 3-month (94%), and 5-month (90%) vaccinations. While the percentage of children receiving their vaccination at each stage declined, only 4% of children were reported to have no vaccinations at 9 months, and for those children that matched to administrative vaccination records[12], 88% had received all vaccinations on time at 6 weeks, 3 months, and 5 months. Moreover, 32% of the children's interviews were conducted in winter (i.e., June, July, or August)[13].

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[11] The proportion for all live births in 2009 is 51.3% and in 2010 is 51.5%.
[12] Children were linked with the National Immunisation Register data.
[13] The month of the interview is estimated based on the child's birth month and their age at the time of the 9-month survey.

For the children in this sample, the average mother was 30.0 years of age at the time of the antenatal survey, which is slightly older than the mothers' median age at birth of 29.9 years in 2009 and 2010. (Statistics New Zealand, 2019b) The average mother, pre-pregnancy, was also slightly overweight with an average BMI of 25.4.[14] Approximately 10% of mothers reported their general health, pre-pregnancy, as poor (2%) or fair (8%), which is similar to the proportion of adults reporting their general health in the New Zealand Health Survey in 2006/2007 and in 2011/2012 (Ministry of Health, 2008, 2012b). We also found 24% of mothers reporting that they ever had asthma and 11% reporting that they smoked regularly at the time of the antenatal interview (i.e., during pregnancy)[15]. In the 9-month survey, 14% of mothers reported that they smoke regularly (i.e., at least one cigarette per day)[16].

In the antenatal survey, mothers were asked to report their main ethnicity (i.e., the ethnicity they identified with most). Using this measure, Asian (15%) and Pacific (15%) peoples are overrepresented in our sample relative to the total population (9% and 7%, respectively in 2006). Europeans were underrepresented – 54% in our sample but 68% of the population in 2006. The percentage of Māori mothers in our sample (14%) is close to the percentage of Māori in the 2006 population (14.6%). (Statistics New Zealand, 2020) Moreover, in our sample, 36% of mothers reported that they were immigrants in the antenatal survey.

For the households of the children in our sample, 29% had at least one smoker (not including the mother). These households are also more likely to be in a rented dwelling (49%) than the average household (31% in 2006) in New Zealand. Low-income households (less than $30,000 annually) are underrepresented (11% in our sample compared to 22% in the 2013 Census) while middle-income households are overrepresented (45% with incomes between $50,000-100,000) relative to the overall population (33%[17] in the 2013 Census).

Housing Conditions

Table 2 provides our main measures of housing conditions from the 9-month survey, with 11% of mothers reporting that their homes were not heated, 23% reporting that the baby's room (i.e., where the baby slept at night) was not

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[14] The BMI was calculated using the mother's self-reported height and pre-pregnancy weight. A BMI in the range of 18.5-24.9 is considered normal weight, while a range of 25-29.9 is considered overweight.

[15] In 2010, 16% of pregnant women in New Zealand were smokers. (Ministry of Health, 2012a)

[16] In 2009, 20.8% of females aged 15-64 were current smokers and 19.2% report smoking daily.

[17] In the 2013 Census, 15% of households reported incomes between $50,000-$70,000 and 18% between $70,000-$100,000.

heated, 21% reporting that the house is quite often, almost always or always damp, 22% reporting that the baby's room quite often, almost always or always had heavy condensation, and 13% reporting that the baby's room had mould or mildew on the walls or ceiling in the past two weeks.

Table 3 shows mothers' more detailed responses about dampness in the house and in the baby's room. For our indicator variable of a damp home (baby room), we combine the 'quite often' and 'always/almost always' categories to indicate that the home (baby room) is damp and the 'never/hardly ever' and 'not very often' to indicate the home (baby room) is not damp.

Previous surveys in New Zealand indicate that these estimates are not out of bounds. For example, 15% of respondents to the 2010/2011 General Social Survey reported that the major housing problem they had was 'the house is too cold or difficult to heat/keep warm' and 10% reported damp as a major housing problem. Moreover, 21% of people in sole-parent families and 16 percent of couples with children reported living in a cold house, and 16% of sole parent families and 10 percent of couples with children reported living in a damp house. (Statistics New Zealand, 2013) In the 2014/2015 General Social Survey, 21% of respondents reported that their house or flat was always or often colder than they would like, 26% reported that dampness or mould was a minor problem, and 6% reported that dampness or mould was a major problem. (Statistics New Zealand, 2015)

For crowding, we estimate that between 11 and 22% of GUiNZ households are considered crowded (depending on the measure used) at the 9-month survey. Comparing these numbers to estimates from the antenatal survey as shown in Table 4, we find that the percentage of crowded households increased (almost doubling) between the antenatal and 9-month surveys regardless of the measure used. Looking at the breakdowns for the estimated number of people in the household per bedroom, the biggest decline was in the percentage of households with less than 2 people per bedroom (from 86% to 79%) and with increases in the other groupings. These estimates are comparable to previous estimates of crowding in New Zealand which are generally based on Census data. From the 2006 Census, 5% of households and 10% of people were estimated to live in a crowded situation (using the CNOS measure); however, children aged 0-9 years had the highest rate of crowding, 17%, of any age group with crowding increasing with the number of dependent children in the household. (Statistics New Zealand, 2012)

Given the nature of damp, cold, and mould, we would expect households with one of these problems to be more likely to have the other conditions as well. Hence, we estimate the overlap of these conditions and find that this is the case. The Venn diagram in Figure 1 compares the clustering we see in the GUiNZ homes (left panel) to a baseline that assumes these conditions are randomly

assigned to homes. We find that 7% of children's homes are both damp and mouldy, this means that about one-third of homes that are damp are also mouldy. We also find that 3% of homes are both damp and unheated, 3% are mouldy and unheated and 2% are damp, mouldy, and unheated. Hence, of our damp homes, approximately 16% are also unheated and 9% are mouldy and unheated. If we randomly assigned these conditions to the same number of homes in our sample, we would expect 3% to be both damp and mouldy, 2% to be damp and unheated, 2% to be mouldy and unheated, and 0.3% to be damp, mouldy and unheated. Hence, the likelihood of finding these conditions in the same home seems to go beyond random chance.

To add household crowding to our analysis of the overlap in housing conditions, we did a similar analysis but split the sample into crowded[18] and not crowded households (shown in Figure 2). We found that conditions in children's households that are not crowded are similar to (though slightly better than) those seen in the actual clustering (left) panel in Figure 1. However, children in crowded households are much more likely to live in cold, damp, or mouldy homes. From the left panel of Figure 2, we see that 39% of children in crowded households live in damp homes compared to 19% of households that are not crowded (right panel). We also found that 27% of children in crowded households live in houses that are mouldy and 29% are unheated compared to 11% and 8%, respectively, of children in households that are not crowded. Moreover, 20% of children in crowded households are both damp and mouldy, and 8% are damp, mouldy, and unheated. Hence, for children in crowded homes, about half of those living in damp homes are also living in mouldy homes (compared to 29% of children in households that are not crowded) and 21% of those living in damp homes live in homes that are also mouldy and not heated (compared to 5% of children in households that are not crowded.

Given the overlap in these conditions, we examine this more formally using correlations. Table 5 shows the correlation coefficients for the different measures of the housing conditions we use, and we see that dampness in the house and dampness in the baby's room are highly correlated (r=0.520). As expected, mould in the baby's room is highly correlated with dampness in the house (r=0.332) and dampness in the baby's room (r=0.335). However, the correlations between unheated baby rooms and dampness in the house or in the room are relatively low (r=0.099 and r=0.092, respectively). Lack of heating in either the house or the baby's room also has a fairly low correlation with mould in the baby's room (r=0.122 and r=0.128 respectively). The correlation coefficients for crowding and the other housing coefficients is in between these

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[18] For our measure of crowded, we use the threshold of more than 2 people per bedroom.

two extremes – ranging from r=0.158 (mould in the baby's room) and 0.211 (unheated house).

Given the correlation between these different measures, we use a principal components analysis to create uncorrelated indices for the underlying factors that these questions are measuring. We first start with all the housing condition measures, including household crowding (more than 2 people per bedroom). The eigenvalues for the principal components are shown in Table 6 and Figure 3, with two principal components having eigenvalues greater than one[19] that explain 60% of the total variance in these measures. The eigenvectors with their component loadings[20] are shown in Table 6. Given the low component loading for the household crowding measure on the first component (0.336) and its high loading on the third component (0.936), we re-ran the analysis without the crowding measure. The first two principal components without the crowding measure have eigenvalues that are again greater than one as shown in Table 7 and Figure 4 and, more importantly, explain 69% of the total variance – more than with crowding included. This indicates that crowding does not fit as well with the other measures and that we can develop better indices for the housing condition without including crowding.

The eigenvectors for the analysis without crowding are shown in Table 7. Now, the first component loadings are all above 0.4 and have fairly similar magnitudes which indicates that this component is measuring the overall condition of the home. For the second component, the similar, high, positive magnitudes of the loadings for lack of heat in the home and in the baby's room combined with the negative loadings on our dampness and mould measures indicate that this index is distinguishing the lack of heating from dampness and mould. We used these results to create two indices – one related to the overall condition of the home (the first component) and one related to the lack of heating in the home (the second component). Moreover, these two indices are designed to be uncorrelated with one another, which means that we can use these measures simultaneously as explanatory variables without worrying about multicollinearity as we might when using the other housing conditions as explanatory variables.

To examine risk factors for these housing conditions, we used logistic regression to see which household characteristics are correlated with our housing conditions. First, we examined the individual house conditions without including the other housing conditions as explanatory variables. The results are shown in

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[19] The purpose of principal components analysis is typically used for variable reduction, especially if there may be redundancy in those variables. The general rule is to use principal components with values greater than one, first suggested by Kaiser (1960), because the component is explaining more of the variance than any one of the original variables.

[20] Component loadings are the individual values in each eigen vector and are generally interpreted as the correlation of each item with the principal component.

Table 8, with the coefficients reported as odds ratios[21]. In all the regressions, the explanatory variables include the following:

- an indicator for 9-month survey interviews conducted in winter,
- household income,
- housing tenure,
- an indicator that the mother smokes,
- an indicator that others in the household smoke,
- an indicator if the mother reports ever having asthma (antenatal survey),
- the mother's pre-pregnancy BMI (antenatal survey), and
- the self-reported general health of the mother pre-pregnancy (antenatal survey).[22]

In a second set of regressions (in the even numbered columns in Table 8), we also control for whether the mother is currently partnered, the age of the mother at the antenatal survey, and the mother's preferred ethnicity.

From these results, we find some consistent patterns. First, the interview being conducted in winter is a significant factor for our measures of damp, mouldy, and unheated homes but not for crowding. For damp and mould, winter interviews increase the likelihood of reports of these issues; however, reports of unheated homes are less likely in winter. This may mean that respondents interviewed in summer months are responding about current heating needs as opposed to responding about heating the house throughout the year.

Household income is also a strong predictor of these conditions. The odds ratios for households in the lower income brackets are highly significant for damp, crowding, and not heating the house but less so for mould in the baby's room. Specifically, in Column (1) of Table 8, we can see that the odds of living in a damp house for children in households with household incomes less than $30,000 annually are more than twice (2.144 times in fact) those of children living in households making more than $150,000, and this coefficient is significant at the 99% level. For these same children, the odds of having water or condensation in their bedrooms are also almost 2.5 times more (shown in columns 3 and 4). Interestingly, the odds ratios in all four dampness specifications increase slightly for the next two income groups (and stay significant at the 99% confidence level), peaking for children in households with

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[21] Odds ratios measure the association between a characteristic or exposure and an outcome and are typically used in health to determine if a given characteristic or exposure increases or decreases the likelihood of an outcome. An odds ratio greater than one indicates that the characteristic/exposure increases the likelihood of the outcome (a risk factor) relative to the comparison group without the characteristic/exposure. An odds ratio less than one indicates that the characteristic/exposure reduces the likelihood of the outcome (a protective factor).

[22] We include characteristics of the mother from the antenatal survey in these regressions even though the housing conditions are measured in the 9-month survey in order to compare to similar regressions of the child's health measures.

incomes in the $50-70,000 range but still significant for those with incomes between $70-100,000.[23] Only children in the last income group ($100-$150,000) have the same odds of living in a damp house or damp room than the highest income group. The results for mould in the baby's room are less strong, with only those children living in households with incomes of $50,000 or less having higher odds (approximately 1.6 times) of living in a home with mould in their bedroom (in the last two weeks) relative to children in the highest income households.

Household income is also a significant risk factor for crowding, with the likelihood of crowding generally decreasing as income increases. The odds of living in crowded conditions for children in the lower income groups are between 2.5 and 4.5 times those in the highest income group.

Children in the lowest income households ($30,000 or less annually) have significantly higher odds of living in homes and sleeping in rooms that are unheated. The next two income groups also have significant odds ratios for living in unheated houses, but these lose their significance when additional information about the mother is added (partnered, age, ethnicity). The same is not true for the risk of children sleeping in an unheated room. Children living in households with annual incomes of $100,000 or less are significantly more likely (at the 95% confidence level) to sleep in an unheated room compared to children living in households with annual incomes of $150,000 or more.

Housing tenure is another strong and consistent explanatory variable, with rental properties having significantly higher odds of having these conditions compared to owner-occupied homes, which is consistent with previous work in this area. However, by distinguishing public rentals from private rentals, we find that the odds of living in damp, mouldy, unheated, or crowded housing are substantially higher for children living in public rentals compared to children living in private rentals, with odds ratios for public rentals generally 1.5-2 times those of private rentals.

Two characteristics of the mother also have a consistently strong association with these housing conditions: pre-pregnancy BMI and ethnicity. Generally, children with mothers whose preferred ethnicity is not NZ European are more likely to live in damp, mouldy, cold or crowded homes. Moreover, higher BMI is associated with an increased likelihood that children live in these conditions. It should also be noted that mother's age is generally associated with these housing conditions until we add household income to the regressions (results not shown). Partnered status generally is not found to be associated with any of the housing conditions.

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[23] In column 10 of the table, we lose significance on some of the income categories when we add ethnicity to the regression. This may be due to the high correlation between income and ethnicity.

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In Table 9, we show the results of the logistic regression for mould in the baby's room using the other housing conditions as explanatory variables first and then adding in the explanatory variables used in the previous regressions. Using only the housing conditions as explanatory variables (Column 1) demonstrates that the unadjusted odds-ratios for these conditions is significant and large, especially for dampness in the house – homes that are damp are 6 times more likely to have mould in the baby's room. Adding in our first set of explanatory variables (Column 2) reduces the magnitude of the odds ratios, and the odds ratio for an unheated house becomes insignificant. In this specification, living in a private or a public rental are significant risk factors. Adding in the second set of explanatory variables (Column 3) does not substantially change the results from the previous specification. Columns 4-6 in Table 9 use the indicators for dampness and lack of heating in the baby's room instead of the indicators for these in the house more generally, but the results remain largely unchanged to those in Columns 1-3. The exception is that not heating the baby's room remains a significant risk factor for having mould in the baby's room after we add in the other explanatory variables (whereas the odds ratio on lack of heating in the home was insignificant); however, the effects are of similar magnitude and the t-statistics indicate that the loss in significance is due to sampling errors. This may also be indicative of mould in the baby's room being more related to heating in the baby's room than heating of the house more generally. These results indicate that the relationship between these housing conditions and the characteristics of the households and children living in them are complex.

We also use logistic regression to examine the consistency of the correlates with both measures of crowding as well as the consistency of the correlates across waves. The results for the antenatal wave are shown in Table 10, and the results for the 9-month survey are shown in Table 11. First, we find that the results are largely consistent between the two crowding measures with the different thresholds (2+ people per bedroom and >2 people per bedroom) in both waves – results for the less restrictive threshold (2+ people per bedroom) are shown in the first set of columns (1-5) and results for the less restrictive threshold (2+ people per bedroom) are shown in the second set of columns (1A-5A). One exception to the consistency of measures is that being partnered is sensitive to both the measure and timing. The more restrictive measure (>2 people per bedroom) is a significant risk factor in some specifications in the 9-month survey but is insignificant in all specifications in the antenatal survey. In contrast, the less restrictive measure (=2 people per bedroom) is a significant risk factor in some specifications in the antenatal survey but is insignificant in all specifications in the 9-month survey. We also find that private rentals are significant risk factors except in the antenatal survey using the more restrictive measure (>2 people per bedroom). We also find that the most significant

predictor of household crowding in the 9-month survey is crowding in the antenatal survey. Given the similarity in results between the two crowding measures with different thresholds, we will primarily use the more restrictive measure in the following analyses.

Health Conditions

Child Health Conditions

We have a number of different measures for children's health outcomes from the 9-month survey that we use in our regression analysis: whether or not a child had a specific type of illness in the first 9-months (binary), the number of times the child had the illness (categorical), the number of times the child visited the doctor for the illness (categorical), and the number of times the child was hospitalised for the illness (categorical). In addition to these measures from the survey, we also use measures based on administrative data from the Ministry of Health's National Minimum Dataset (NMDS) about hospitalisations due to respiratory infections which have been linked to the GUiNZ child data. From these data, we have measures for 1) whether the child was admitted to hospital (binary), 2) the number of times the child was admitted to hospital, and 3) the number of days the child was hospitalised due to a respiratory infection in their first year. The administrative data are top-coded counts for both hospitalisation admissions (5+) and days hospitalised (9+).

Figure 5 shows the percentage of children reported to have each of these conditions at least once in their first nine months, the percentage of the full sample who saw a doctor at least once for each condition, and the percentage of children who were admitted to hospital at least once. Figure 6 shows the conditional percentages of children's medical utilisation (saw a doctor or were hospitalised) given that they were reported to have the health condition at least once. From these graphs, we see that cough was both the most prevalent condition reported (45.0% of children) and had the largest percentage of children with a doctor visit (38.6%). However, chest infections had the largest percentage of children with a hospital admission (4.8%). Looking at the conditional rates, chest infections still had the highest rate of hospitalisation, with 17.9% of children who were reported to have a chest infection being hospitalised. The second highest conditional hospitalisation rate was for gastroenteritis (7.2%). For doctor visits, the highest conditional rate was for ear infections – 98.0% of children with ear infections saw a doctor at least once. However, rates for chest infections were only slightly lower (95.5%). The lowest conditional rate for doctor visits was for gastroenteritis (69.2%).

For each illness, the vast majority (at least 89%) of children with the illness were reported having it 1-3 times in their first 9 months as shown in the top panel of Figure 7. Chest infections had the highest percentage of children

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reported having the illness more than 3 times – with 7.8% reported as having the illness 4-6 times and 3.2% reported as having the illness 7+ times within their first nine months (conditional on having it at least once).

The middle panel of Figure 7 reports the number of doctor visits reported for each illness conditional on children having had the illness in their first nine months. Most children reported as having the illness were also reported as having seen a doctor due to the illness. Gastroenteritis had the highest percentage (30.8%) of children reported as having the illness who did not see a doctor. As with the number of times children were reported as having an illness, the children reported as having chest infections had the highest percentage of children seeing a doctor more than 3 times for the condition – with 12.5% reported as seeing a doctor 4-6 times and 5.1% seeing a doctor 7 or more times. Children with chest infections also had the most children reported as being hospitalised 1-3 times (17.2%) and was the only health condition where children were hospitalised 4 or more times, though this percentage was less than 1%. This is shown in the bottom panel of Figure 7.

For the binary health outcome measures, we use logistic regression as we did with the binary housing condition measures. For the categorical health outcome measures, we used ordered logistic regression, and for the top-coded count data we used a censored Poisson regression.

The results of the logistic regression for chest infections (including wheezing, bronchiolitis, bronchitis, asthma, pneumonia, or croup) are shown in Table 12. The odds ratios for the damp, mould, and unheated measures indicate that these are significant risk factors for chest infections in these children before controlling for any household, child, or mother characteristics (Columns 1-4)[24]. It should be noted, however, that crowding is not a significant risk factor in any of the specifications[25]. We also find that the overall housing condition index (based on the first principal component) is a significant risk factor for chest infections, but the odds ratio for the second index is not significant (Column 5). After we add the initial set of control variables (i.e., household income, housing tenure, child's gestational age, gender (male), child's age at the 9-month survey, whether the interview was in winter, and number of children born by the mother at the child's birth), there is a reduction in the magnitude of the odds ratios on the damp, mould, unheated, and overall housing condition index measures but all remain significant (Column 6). Adding controls for the child's vaccinations,

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[24] It is important to note that the effects of each covariate on the coefficients of interest are approximately orthogonal (i.e., the estimates and the standard errors remain approximately the same as other variables are added). This implies that the effects of each housing condition on chest infections may be additive, but this is surprising given the overlap seen in the Venn diagrams.
[25] When crowding was the only independent variable in the regression, the odds ratio was significant (results not shown).

whether the mother currently smokes, and whether there are other smokers in the household gives similar results (Columns 7-9).

It is not until we add further controls for the mother (i.e., ever had asthma, self-rated pre-pregnancy health, and pre-pregnancy BMI) that we lose significance for the damp, mould, and unheated indicators, though it should be noted that the odds ratio for the damp indicator is still significant at the 90% confidence level (Column 11). Moreover, adding mother's age and preferred ethnicity to the specification (Column 12) results in insignificant odds ratios for the damp, mould, and unheated indicators. Additional robustness checks indicate that the addition of the mother's pre-pregnancy BMI is driving these results (not shown). However, this variable is also a significant predictor of damp, mouldy and unheated homes which makes disentangling their individual effects difficult. We also find that adding the controls for the mother (including the pre-pregnancy BMI) does not have the same effect on the overall housing condition index – the odds ratio on the index remains significant even when all control variables for the mother are included (Column 10).

In Table 12 the number of observations varies greatly – from 4590 to 6460 – due to missing information. So, some of the changes in the results in the different specifications could be due to changes in the sample. For this reason, we re-run the regressions using the smallest sample (from the specification in Column 12). These results are shown in Table 13. The initial estimates are similar (Columns 1-5), though the magnitudes of the odds ratios for our variables of interest (damp, mould, unheated, and overall housing condition) are slightly smaller in the regressions with the smaller sample[26]. Adding the initial control variables to the specification (Columns 6-7) results in insignificant odds ratios for the mould and unheated indicators at the 95-percent confidence level[27]. It is important to note that the odds ratio for the overall housing condition index is significant after adding in the initial controls (Column 9) and remains significant after adding in all control variables.

The results of the ordered logit for the number of times the child had a chest infection in the first 9 months are shown in Table 14. The results are strikingly similar to the results that we found for the logistic regression of whether the child had a chest infection in the first 9 months. This suggests that the important distinction is having had a chest infection and not the number of times the child had an infection. Moreover, we also ran the same ordered logit regressions for the number of times the child went to the doctor or were admitted to hospital

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[26] The coefficient on our damp house measure is has the largest reduction in percentage terms (28%).

[27] The odds ratio for mould is significant at the 90-percent confidence level in the specification shown in column 6. The lack of significance even at the 90-percent level on the odds ratio in Column 7 may be due to the drop in observations given that it is once again significant in the specification in Column 8.

due to chest infections (based on mothers' reports) and found the same patterns (results not shown).

Interestingly, we found that using our measure of dampness in the baby's room in place of our measure of dampness in the house in our chest infection regressions maintains the significance on the odds ratio for dampness across all twelve specifications, and in particular, in the final specification.[28] These results are shown in Table 15.[29] Moreover, the coefficients on mould and lack of heating in the house maintain significance longer. This remains true across all health outcome measures for chest infections (i.e., whether the child had at least one chest infection, the number of chest infections, the number of doctor visits, and the number of hospital admissions), with the results for doctor visits and hospital admissions shown in Table 16. This was also true for the restricted sample.[30]

When we used the administrative data for hospital admissions and number of days in the hospital (in the first 12 months) due to respiratory infections, we used Poisson regression and found that dampness in the house is a significant risk factor even after we add in all the control variables (including mothers' BMI and preferred ethnicity). These results are shown in Table 21. This is in contrast to the results reported in Tin Tin et al. (2016), which found a significant unadjusted odds ratio which became insignificant after adjusting for maternal and child factors. Their specification, however, is different from ours. For example, they used a Cox Proportional Hazards Model using respiratory hospitalisations in the first 5 years of life, and they used the categorical measure for a damp home instead of a binary indicator derived from the categorical measure as we do.

For the other health conditions for the child, we summarise the results in Table 17 (whether or not the child had the illness), Table 18 (number of times the child had the illness), Table 19 (the number of doctor visits for the illness), and Table 20 (the number of hospital admissions). The first thing to note is that the patterns in the results in all four tables is consistent for each health condition. The results for cough are very similar to those for chest illnesses, though the association between dampness in the baby's room and cough is much stronger than that for chest infections with the odds ratio staying strongly significant

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[28] In robustness checks, we found that using lack of heating in the baby's room with dampness in the baby's room in the same specification yielded the same pattern as in Table 12. However, using dampness in the house with heating in the baby's room yielded the same pattern as in Table 15.

[29] To conserve space, we only show the odds ratios for our housing condition measures, but the same explanatory variables are included in the specifications as shown in Table 12. Moreover, the results for these variables also follow the same patterns as those in Table 12.

[30] We conducted a number of robustness checks, including stratifying by income, and the pattern of results remained similar to those reported.

across all the specifications for cough.[31] In addition, the coefficient on the second principal components index is less than one and significant in each specification for cough which indicates that lack of heating is slightly protective. However, this should be interpreted with caution given that the odds of reporting no heating in winter months is lower than those in other months.

Gastroenteritis starts with a significant association with dampness in the baby's room (in Column 1), but it becomes insignificant when mould is added into the equation (in Column 2). Moreover, the association between gastroenteritis and dampness remains significant across all specifications. This is the only health condition where we persistently found an odds ratio that was both significant and greater than one over a number of specifications. It is important to note that gastroenteritis is not one of the health conditions that has previously been found to have substantial evidence of an association with dampness or mould. For skin infections, we also found that the odds ratios for mould, an unheated house, and the index for the overall condition of the house were significant in the initial specifications but then lost significance when all the explanatory variables were added (Columns 10-12). Based on previous literature, we would expect both gastroenteritis and skin infections to be associated with household crowding, so it is surprising to find it associated with dampness or mould. Mendell et al. (2011) found that eczema had sufficient evidence for association with dampness or mould, and while eczema itself is not a skin infection, it can become infected. Hence, it is possible that our measure of skin infections is a proxy for eczema.

For serious skin infections of household members, the logistic regression results (not reported) showed all the housing condition measures (except the second principal components index measure) are significant at the 95-percent confidence level across all specifications. The results for the number of household members with a serious skin condition were similar to those from using the binary measure – the odds ratios on the crowding, damp house, mould, lack of heating in the house, and the overall housing condition index were all highly significant across all specifications (results not shown).

We also examined the relationship between our housing measures and children's health measures between the 9-month and 24-month surveys for those children that did not move. Since we are using only those children that did not move, we had a much smaller sample for these analyses. Still, in this sample, we found that dampness and mould were both associated with significantly increased odds in all twelve specifications. For example, we still find that mould in the baby's room is associated with significantly increased odds of skin infections in the children. In addition, using a new separate measure of wheeze, we found that

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[31] In robustness checks, the same strength of association between cough and dampness was found when using dampness in the house rather than dampness in the baby's room.

wheeze was associated with dampness in the baby's room (though in some specifications the odds ratio was only significant at the 90% confidence level). One surprising finding from this sample was that crowding was associated with lower odds of chest infections which is counter to the results found in the literature. More research will be needed to better understand this result. Overall, however, the results from this sample are largely reflective of the results seen using the health outcomes from the 9-month survey but with typically weaker associations, which is most likely due to smaller sample sizes.

Mothers' Health Conditions

The 9-month survey contains some questions about the mother's own health and about the health of other household members (excluding the baby). For the mother, we use two health outcome measures. One is based on a general question about the mother's overall health (responses include 'poor', 'fair', 'good', 'very good', and 'excellent') which we used to create an indicator as to whether the mother's health is not good (i.e., poor or fair). The second is an indicator as to whether the mother has a cough "on most days". For other household members, the mother was asked if and how many other household members had a serious skin infection over the last 3 months. Both of which we used as health outcome measures for the household. We used logistic regression for the indicator measures and censored Poisson regression (censored at 4) for the number of household members who had a serious skin infection.

Results for the mother having a cough on most days are shown in Table 22 and largely followed the results for the logistic regression for the child's health, with the odds ratios on the housing condition measures being significantly greater than one until the final set of explanatory variables about the mother are added (asthma ever, pre-pregnancy BMI, ethnicity). For the general health measure, however, the odds ratios for mould stayed significant across all specifications as does the odds ratio on the overall housing condition index (results shown in Table 23). For the damp house measure, the odds ratio was significant at the 90-percent confidence level.[32] The odds ratios for the unheated house indicator and for crowding were never significant in any specification.

Parental Stressors

In New Zealand, anecdotal reports indicated that housing difficulties are stressful and that disadvantaged groups tend to be discriminated against in the housing market. To examine the extent of this in our sample, we used questions from the antenatal, 9-month, and 2-year surveys.

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[32] In robustness checks, we used dampness in the baby's room rather than dampness in the house, but that did not change the pattern of results.

First, we used questions from all three surveys asking mothers and their partners about their stress levels due to worry about housing difficulties. *Figure 9* shows that mothers (top panel) worried most about housing difficulties before the baby was born and that mothers reported the lowest levels of worry when the baby was 9 months old. At 2 years, mothers' worry levels went back to approximately the same levels as they were before the baby was born. Overall, about 20% of mothers reported that they were moderately or highly stressed in both the antenatal and 2-year surveys. In the antenatal survey, approximately 8% of mothers reported being highly stressed, approximately 13% reported being moderately stressed, and slightly more than 20% reported being somewhat stressed. Whereas in the 9-month survey, approximately 5% of mothers reported being highly stressed, approximately 9% were moderately stressed, and slightly less than 20 percent were somewhat stressed. Then in the 2-year survey, the percentages reverted to levels similar to those seen in the antenatal survey, though the percentages for moderately and highly stressed were slightly less than those found in the 9-month survey. The percentage reported as somewhat stressed was also slightly higher than in the antenatal survey.

Mothers' reports also indicate that they worry more about housing difficulties than their partners (shown in the bottom panel of *Figure 9*). However, partners' reports had a similar time trend – they were most stressed about housing difficulties before the baby was born, then their stress levels reportedly dropped in the 9-month survey, and finally reverted to antenatal levels in the 2-year survey. As with mothers, about 20% of partners reported being moderately or highly stressed by worries about housing difficulties in the antenatal and 2-year surveys. In the antenatal survey, approximately 5% of partners reported being highly stressed by housing difficulty worries, 14% moderately stressed, and 23% somewhat stressed. In the 9-month survey, the highly stressed group was about 3%, the moderately stressed were slightly less than 9%, and the somewhat stressed comprise slightly more than 20% of all partners. Then, in the 24-month survey, these percentages returned to around the same levels seen in the antenatal survey.

To better understand feelings of discrimination in the housing market, we used questions from the antenatal survey which asked mothers and their partners about feeling unfairly treated due to their ethnicity in a number of different circumstances, including in the housing market, in the job market, in obtaining credit, and in obtaining medical services.

As shown in Figure 11, more mothers than partners reported feelings of unfair treatment due to ethnicity in housing -- as a percentage of the total population, 4.8% of mothers and 3.9% of partners reported unfair treatment. Compared to feelings of unfair treatment in other aspects of life, housing ranked third with the most reports related to the job. Partners reported more unfair treatment related

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to jobs than mothers did. As a percentage of the total population, 7.7% of partners reported feeling unfairly treated compared to 6.5% of mothers. Reports of unfair treatment in health care were slightly higher than reports in housing, with a greater percentage of mothers reporting unfair treatment in health (5.4%) compared to partners (5.0%). Credit had the fewest reports of unfair treatment -- 2.6% of partners and 1.9% of mothers.

We also examined these percentages in terms of those partners and mothers reporting any feelings of unfair treatment due to their ethnicity. Overall, approximately 23% of partners and 20% of mothers reported feelings of unfair treatment due to their ethnicity in some circumstance. Hence, conditional on reporting some form of unfair treatment, 23.3% of mothers and 17.7% of partners reported unfair treatment in housing (shown in *Figure 11*). Unfair treatment in jobs was still the highest amongst our four categories, with 34.3% of partners and 30.7% of mothers reporting unfair treatment. The category with the fewest reports, credit, still had 11.5% partners and 9.2% of mothers reporting unfair treatment.

Discussion

Our results focus on the 9-month survey because this is where we have the best measures of the housing conditions of interest. These results indicate that the housing conditions being studied – damp, mould, cold, and crowding – are overlapping. Homes that are crowded are much more likely to also be cold, damp, and mouldy. Moreover, the combinations of these conditions occur in households much more frequently than random assignment suggests. We also developed an overall housing condition index from our measures of damp, mould and cold using principal components analysis. For household crowding, we examined the use of different measures as well as how it may change over time using the antenatal and 9-month survey. From this, we found that using different thresholds for crowding changed the percentages of children living in crowded households but that the associations between crowding and the other variables were largely the same. We also found that one of the strongest predictors of household crowding at 9 months was the mother living in a crowded household before the baby was born.

Our results suggest that children in low-income households and children living in rented homes are more likely to live with these housing conditions, which is consistent with previous research. However, it is surprising that there is a significant difference in the odds of living in these conditions for children with household incomes up to $100,000 (compared to children with household incomes of $150,000 or more). It is also surprising how much higher the odds were for children living in public rentals compared to those in private rentals and compared to those in owner-occupied homes. It is important to remember that

these results correspond to the 2010/2011 time period and that current efforts are underway to improve public rentals as well as new regulations to improve both public and private rental properties.

In our 9-month sample, our results show that these children have health conditions that have been previously associated in the literature with the housing conditions we examined – almost half of these children had a cough lasting at least a week and more than a quarter were reported to have a chest infection in their first 9 months. Most children with these illnesses also went to the doctor at least once and a fair proportion were hospitalised (close to twenty percent for chest infections). Moreover, a small percentage of children were hospitalised 4 or more times due to chest infections in the first 9 months of their lives.

To better understand the association between these housing conditions and health outcomes, we used regression analysis and found that the unadjusted odds ratios for these health outcome measures indicated an association between homes with these conditions and an increased incidence of these health outcomes for children, mothers, and other household members. After adding controls into the regressions, we tended to see a reduction in these odds ratios and, in some specifications, a loss of significance.

Typically, however, one housing condition dominated the others for each health outcome with consistently strong, significant associations across most specifications. For example, the odds ratio on dampness in the baby's room was highly significant across most specifications for chest infections and cough for children at 9 months, whereas for gastroenteritis and skin infections, mould tended to be the dominant housing condition associated with the condition. Ear infections for children at nine months was the only health outcome that did not have a strong association with any of the housing conditions in our analysis. For mothers, we found a strong and consistent relationship between their self-reported general health and mould, though the odds ratio for dampness was also strongly significant across a number of specifications.

The results for chest infections and cough were not surprising given that the previous literature has found sufficient evidence of an association between dampness/mould and respiratory issues (e.g., cough, wheeze, upper respiratory tract infections, asthma, shortness of breath). (Mark J. Mendell et al., 2011) However, the strong and consistent association seen between mould and gastroenteritis and also between mould and skin infections was surprising. Previous reviews of the literature have found inadequate or insufficient evidence to determine whether an association exists between gastroenteritis or skin infections and dampness or mould. (Institute of Medicine (US) Committee on Damp Indoor Spaces and Health, 2004; WHO Regional Office for Europe, 2009) However, Mendell et al. (2011) found that eczema had sufficient evidence for

association with dampness or mould, and while eczema itself is not a skin infection, it can become infected. Hence, it is possible that our measures of skin infections are proxies for eczema.

The overall housing condition index (PC1) also shows a significant, consistent association with a number of health outcomes – cough, chest infections, ear infections, skin infections, and gastroenteritis – for children in the 9-month sample, which indicates that increasing the number of housing problems also increases the odds of children having these health outcomes. In some specifications, the second housing condition index related to lack of heating in the home was also significant; however, for cough and gastroenteritis, the odds ratio was less than one which indicates that a lack of heating is associated with *reduced* odds of having the health outcome. In similar specifications, the lack of heating measure also had an odds ratio less than one, which indicates that the two measures are picking up the same effects. It is important to note, however, that this second index is negatively correlated with our mould and dampness measures. So, interpreting the results using this second measure is not as straightforward as those for the first index. Given that lack of heating is less likely to be reported in winter interviews also suggests that this measure may be picking up another effect.

These results suggest that policies aimed at reducing the risk of these housing-related health outcomes should take into account all of the problems in the home rather than focusing on a single problem. Moreover, our results suggest that these problems are not limited only to the lowest income households but that even children in middle income households have an increased risk of living in these conditions.

Limitations and future directions

One of the main limitations of this research is that the results describe the association between our housing conditions and health outcomes, but the results are not necessarily indicative of causal relationships. Hence, there may be unmeasured factors related to both the housing conditions and health outcomes that may be driving the associations we have found. Even so, there is a large body of evidence that has linked these housing conditions to adverse health outcomes. (Institute of Medicine (US) Committee on Damp Indoor Spaces and Health, 2004; M. J. Mendell & Kumagai, 2017; Mark J. Mendell et al., 2011; WHO Regional Office for Europe, 2009; World Health Organization, 2018) The evidence is particularly strong[33] for an association between indoor dampness and

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[33] In fact, the evidence has been rated as "sufficient to conclude that there is an association" which means that the association between the agent and the outcome has been observed in studies in which chance, bias and confounding could be ruled out with reasonable confidence. (WHO Regional Office for Europe, 2009)

mould and a wide range of respiratory symptoms, including wheeze, asthma, cough, and chest infections. (Institute of Medicine (US) Committee on Damp Indoor Spaces and Health, 2004; M. J. Mendell & Kumagai, 2017; Mark J. Mendell et al., 2011; WHO Regional Office for Europe, 2009; World Health Organization, 2018)

Another limitation of this research is that the sample of children, while representative of births in New Zealand, are not necessarily living in households representative of the general population in New Zealand. For example, most of the children were born and live in the area around Auckland which tends to have a warmer climate then most of the rest of the country. Hence, lack of heating in homes may be less of a problem than in colder climates in New Zealand. We also lose a number of observations due to attrition and missing data. In our main sample of data, missing data is far more of an issue than attrition, especially missing household incomes. However, when running our regression specifications, we used both the full sample and the sample with no missing information for our measures and found that the pattern of results for both samples was similar.

The measures that we used for our housing conditions and health outcomes were primarily self-reported. This could potentially bias our results since parents of children with these health outcomes may be more aware of these housing conditions than parents of children without them. However, in much of the literature on this topic, exposure to damp or mould was generally measured subjectively with the presence of damp or mould indicated by sight or smell (e.g., visible mould or dampness, mouldy or musty odour), and previous research has shown that self-reports of dampness and mould (especially the smell of mould/mildew) are consistently linked with a significantly increased risk of health effects with comparable results to more quantitative measures. (M. J. Mendell & Kumagai, 2017; Shorter et al., 2018) Hence, using self-reported or other subjective measures of damp and mould is supported by current research.

There are also some limitations in how the questions were asked. For example, the mould question had a time limit (in the last 2 weeks) while the other questions for heating and dampness did not. Further, it appears there is some seasonality to the responses to these questions. While we control for winter interviews in the regression analysis, the other summary statistics are not reported separately. Moreover, asking whether someone heats their home (or baby's room) does not provide much information about the indoor temperature or about how long the home or room is heated. It is possible that parents only heat the child's bedroom just before the child goes to sleep. This may be the reason that we do not find a strong association between our lack of heating measures and the health outcome measures.

This analysis is also potentially limited by small sample sizes, especially as we add explanatory variables to the analysis. There is some evidence that the loss in significance for some of the coefficients is due to a loss in precision. Increasing the sample size would provide more confidence in the results, but that is not feasible given the unique nature of this longitudinal study. Further research could be done using different data sources. For example, new data collected about housing conditions in the NZ General Social Survey and in the Census could provide more information about the housing conditions – especially about the overlap in these conditions; however, there is not the same level of detail available about the health conditions for people living in those homes.

More research is also needed about the association between indoor mould and gastroenteritis or skin infections. Our research is indicative of a strong association, and previous research has shown similar linkages, but the quality of the evidence is not as strong as it is for respiratory issues and damp or mould. Further research is also needed to more carefully examine how overlapping conditions affect the risk of these health conditions. Our results suggest that the effects may be additive, but again, may be limited by small sample sizes. Finally, the lack of association between our proxies for cold indoor temperatures (not heating the house or baby's bedroom) and many of our health outcomes is surprising. It appears to be a problem with our proxy measure, but more work is needed to determine if this the case.

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Tables

Table 1. Summary Statistics of GUiNZ Children and Households

Variable	9-month Survey Mean (SD)
Interview	
Winter	32%
Child Characteristics	
Male	52%
Age (weeks)	38.71
	(3.83)
Birthweight (grams)	3482.40
	(583.12)
Number of GUiNZ Children Born	1.03
	(0.17)
Gestational Age	
PreTerm (<37 GW)	6.30%
Term (37-41 GW)	91.27%
PostTerm (>41 GW)	2.43%
Vaccinations	
Birth	42%
6 weeks	95%
3 months	94%
5 months	90%
No vaccinations @ 9 months	4%
All vaccinations given on time (6w, 3m, 5m)	88%
Mothers' Characteristics	
Age Mother (Antenatal)	30.06
	(5.86)
BMI, Pre-pregnancy	25.40
	(5.94)
General Health, Pre-pregnancy	
Poor	2%
Fair	8%
Good	34%
Very Good	35%
Excellent	20%

Preferred Ethnicity	
NZ/European	54%
Maori	14%
Pacific	15%
Asian	15%
Other	2%
Immigrant	36%
Asthma ever	24%
Current Smoker	
Antenatal Survey	11%
9-month Survey	14%
Household Characteristics	
Annual Household Income	
<=30K	11%
>30K <=50K	18%
>50 <=70K	22%
>70K <=100K	23%
>100K <=150K	17%
>150K	10%
Housing Tenure	
Private Rental	38%
Public Rental	7%
Other Rental	4%
Own	51%
Other Smokers in HH (9-month)	29%

Table 2. Housing Conditions as Reported by Mother at 9 Months

Housing Condition	Households with Condition (%)
Unheated (Cold)	
Baby's room	23%
House	11%
Damp	
Baby's room (heavy condensation)	22%
House (damp)	21%
Mould	
Baby's room (last 2 weeks)	13%
Crowded	
Crowded (>=2 ppl per bedroom)	22%
Crowded (ignoring capped responses)	22%
Crowded (>2 ppl per bedroom)	11%

Table 3. Mothers' Response to Dampness Questions in 9-month Survey

Mother's Response	How often is the baby's house damp?	How often does room where baby sleeps at night have heavy condensation* on the walls?
Never/hardly ever	50%	51%
Not very often	29%	27%
Quite often	15%	16%
Always/almost always	6%	6%

*Heavy condensation includes water trickling down the walls/windows or puddle of water at the bottom of a wall/window.

Table 4. Crowding Measures Between Antenatal and 9-month Surveys

	Antenatal Survey	9-Month Survey
Crowding		
Crowded (>=2 ppl per bedroom)	14%	22%
Crowded (ignoring capped responses)	14%	22%
Crowded (>2 ppl per bedroom)	6%	11%
People per bedroom		
<2	86%	79%
=2	8%	10%
2-3	4%	7%
3+	2%	4%
People per bedroom		
Mean	1.24	1.52
Std. Dev.	0.59	0.59

Table 5. Correlation of Housing Condition Measures

Variable	PC1 Index	PC2 Index	Damp (House)	Damp (Baby)	Mould (Baby)	Unheated (House)	Unheated (Baby)
PC1 Index	1						
PC2 Index	0	1					
Damp (House)	0.685***	-0.447***	1				
Damp (Baby)	0.677***	-0.467***	0.520***	1			
Mould (Baby)	0.618***	-0.286***	0.332***	0.335***	1		
Unheated (House)	0.568***	0.700***	0.092***	0.072***	0.122***	1	
Unheated (Baby)	0.568***	0.686***	0.099***	0.092***	0.128***	0.628***	1
Crowded	0.280***	0.0627***	0.159***	0.161***	0.158***	0.211***	0.200***

* p<0.05, ** p<0.01, *** p<0.001

Table 6. Eigenvectors of Principal Components (PC) Analysis for Housing Conditions, Including Crowding

Variable	PC1	PC2	PC3	PC4	PC5	PC6
Unheated (House)	0.405	0.545	-0.189	-0.039	-0.035	0.707
Unheated (Baby)	0.412	0.531	-0.218	-0.053	0.056	-0.703
Damp (House)	0.444	-0.404	-0.136	-0.353	-0.704	-0.033
Damp (Baby)	0.438	-0.420	-0.115	-0.339	0.707	0.057
Mould (Baby)	0.405	-0.269	-0.093	0.869	-0.008	-0.003
Crowding (>2 ppl per BR)	0.336	0.097	0.936	-0.027	-0.010	-0.018
Eigenvalues	2.11	1.47	0.85	0.72	0.48	0.37
Proportion of Total Variance	0.35	0.24	0.14	0.12	0.08	0.06

Table 7. Eigenvectors of Principal Components (PC) Analysis for Housing Conditions, Excluding Crowding

Variable	PC1	PC2	PC3	PC4	PC5
Unheated (House)	0.404	0.580	-0.045	-0.035	0.705
Unheated (Baby)	0.415	0.568	-0.058	0.051	-0.706
Damp (House)	0.488	-0.370	-0.357	-0.705	-0.033
Damp (Baby)	0.482	-0.385	-0.342	0.707	0.053
Mould (Baby)	0.440	-0.236	0.866	-0.010	-0.003
Eigenvalues	1.97	1.46	0.72	0.48	0.37
Proportion of Total Variance	0.39	0.29	0.14	0.10	0.07

Table 8. Logistic Regressions for Individual Housing Conditions (9-month survey)

Variable	(1) Damp (House)	(2) Damp (House)	(3) Damp (Baby)	(4) Damp (Baby)	(5) Mould (Baby)	(6) Mould (Baby)	(7) Crowded (>2 per BR)	(8) Crowded (>2 per BR)	(9) Unheated (House)	(10) Unheated (House)	(11) Unheated (Baby)	(12) Unheated (Baby)
Winter Interview	1.572***	1.558***	1.872***	1.847***	1.293**	1.282**	1.010	0.926	0.514***	0.447***	0.682***	0.651***
	(5.39)	(5.25)	(7.88)	(7.66)	(2.48)	(2.37)	(0.08)	(-0.58)	(-4.54)	(-5.48)	(-4.21)	(-4.65)
Household Income -- omitted >$150K												
<=30	2.144***	2.092***	2.491***	2.481***	1.628**	1.582*	4.485***	3.203***	3.759***	2.518***	3.089***	2.620***
	(3.56)	(3.35)	(4.70)	(4.55)	(2.02)	(1.87)	(4.12)	(3.18)	(3.70)	(2.60)	(5.29)	(4.38)
>30K <=50K	2.216***	2.129***	2.212***	2.133***	1.572**	1.528*	4.433***	3.204***	2.494***	1.701	2.501***	2.180***
	(4.01)	(3.74)	(4.44)	(4.16)	(2.01)	(1.86)	(4.33)	(3.37)	(2.66)	(1.57)	(4.61)	(3.85)
>50 <=70K	2.380***	2.266***	2.044***	1.974***	1.481*	1.421	3.336***	2.525***	2.195**	1.584	2.240***	2.003***
	(4.51)	(4.19)	(4.11)	(3.84)	(1.81)	(1.59)	(3.52)	(2.69)	(2.36)	(1.37)	(4.19)	(3.55)
>70K <=100K	1.692***	1.649**	1.630***	1.596***	0.985	0.968	1.900*	1.615	1.568	1.358	1.715***	1.636**
	(2.72)	(2.57)	(2.85)	(2.71)	(-0.07)	(-0.15)	(1.83)	(1.36)	(1.34)	(0.92)	(2.81)	(2.55)
>100K <=150K	1.171	1.149	1.210	1.184	0.896	0.883	1.105	0.953	1.372	1.248	1.453*	1.397
	(0.75)	(0.66)	(1.03)	(0.91)	(-0.46)	(-0.53)	(0.26)	(-0.12)	(0.89)	(0.62)	(1.84)	(1.63)
Housing Tenure -- omitted 'Own'												
Private Rental	2.410***	2.272***	1.680***	1.627***	1.780***	1.657***	1.538***	1.246	2.301***	1.898***	1.443***	1.262**
	(9.47)	(8.58)	(5.88)	(5.37)	(5.02)	(4.24)	(3.11)	(1.52)	(5.48)	(4.07)	(3.98)	(2.44)
Public Rental	4.123***	3.225***	3.290***	2.694***	3.595***	2.835***	4.768***	2.534***	4.960***	2.614***	2.662***	1.703***
	(8.21)	(6.49)	(6.94)	(5.55)	(6.63)	(5.15)	(7.12)	(3.90)	(7.06)	(3.98)	(5.71)	(2.98)
Other Rental	2.100***	2.040***	1.587**	1.629***	0.779	0.737	0.561	0.574	1.039	1.084	1.173	1.161
	(4.07)	(3.84)	(2.53)	(2.67)	(-0.84)	(-1.01)	(-1.42)	(-1.29)	(0.10)	(0.22)	(0.77)	(0.69)
Mother Smokes	0.864	0.897	0.936	1.077	1.046	1.021	0.777	1.031	0.729	0.920	1.045	1.094
	(-1.02)	(-0.73)	(-0.46)	(0.50)	(0.26)	(0.12)	(-1.35)	(0.15)	(-1.63)	(-0.40)	(0.32)	(0.61)
Other Smokers in HH	1.254**	1.173	1.068	1.030	1.173	1.094	1.833***	1.554***	1.801***	1.487***	1.755***	1.552***
	(2.10)	(1.44)	(0.60)	(0.27)	(1.19)	(0.66)	(4.13)	(2.97)	(3.93)	(2.58)	(5.34)	(4.08)
Asthma ever (Mother)	0.964	1.005	0.959	1.059	0.909	0.910	0.593***	0.854	0.488***	0.652**	0.797**	0.895
	(-0.39)	(0.05)	(-0.46)	(0.62)	(-0.83)	(-0.79)	(-3.57)	(-1.02)	(-4.41)	(-2.50)	(-2.33)	(-1.11)
BMI (Mother Pre-pregnancy)	1.033***	1.024***	1.023***	1.020***	1.021***	1.011	1.034***	1.019*	1.027***	1.012	1.029***	1.017**
	(4.93)	(3.36)	(3.63)	(2.82)	(2.62)	(1.24)	(3.79)	(1.85)	(3.08)	(1.25)	(4.52)	(2.38)
General Health, Mother Pre-pregnancy -- omitted 'Poor Health'												
Fair	1.417	1.483	0.897	0.925	1.244	1.286	0.681	0.717	0.798	0.799	0.993	1.048
	(1.21)	(1.35)	(-0.40)	(-0.28)	(0.66)	(0.76)	(-1.04)	(-0.88)	(-0.57)	(-0.55)	(-0.02)	(0.16)
Good	1.268	1.348	0.697	0.710	0.873	0.927	0.698	0.765	0.862	0.900	1.048	1.162
	(0.90)	(1.12)	(-1.44)	(-1.37)	(-0.44)	(-0.25)	(-1.07)	(-0.78)	(-0.42)	(-0.29)	(0.18)	(0.56)
Very good	1.016	1.110	0.598**	0.632*	0.837	0.909	0.493**	0.639	0.726	0.922	0.944	1.147
	(0.06)	(0.38)	(-2.03)	(-1.81)	(-0.58)	(-0.31)	(-2.06)	(-1.26)	(-0.89)	(-0.22)	(-0.21)	(0.50)
Excellent	1.107	1.196	0.677	0.716	0.887	0.965	0.609	0.843	0.591	0.746	0.980	1.217
	(0.36)	(0.63)	(-1.49)	(-1.26)	(-0.37)	(-0.11)	(-1.39)	(-0.47)	(-1.38)	(-0.75)	(-0.07)	(0.69)
Partnered (Mother)		1.301		1.280		1.297		1.200		0.686*		1.006
		(1.58)		(1.51)		(1.34)		(0.78)		(-1.70)		(0.04)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Age (Mother Antenatal)		0.994		1.011		0.993		1.007		0.971**		0.992
		(-0.74)		(1.42)		(-0.71)		(0.61)		(-2.38)		(-1.02)
Preferred Ethnicity (Mother) -- omitted NZ/European												
Maori		1.394***		1.163		1.750***		4.400***		1.776***		2.163***
		(2.70)		(1.22)		(3.87)		(7.64)		(2.75)		(6.18)
Pacific		1.997***		1.875***		1.842***		10.37***		8.139***		3.708***
		(4.99)		(4.58)		(3.70)		(12.02)		(12.03)		(10.01)
Asian		1.031		1.464***		0.919		6.168***		3.745***		1.733***
		(0.24)		(3.30)		(-0.52)		(10.15)		(7.67)		(4.52)
Other		1.709**		2.094***		1.783**		3.145***		2.469**		1.697**
		(2.30)		(3.32)		(2.09)		(2.97)		(2.33)		(2.02)
Observations	4615	4611	4615	4611	4610	4606	4612	4608	4613	4609	4613	4609
Pseudo R-squared	0.088	0.096	0.066	0.074	0.057	0.066	0.133	0.216	0.122	0.191	0.073	0.099

Coefficients are odds ratios; t statistics in parentheses

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 9. Logistic Regressions for Mould, Housing Characteristics as Explanatory Variables

Variable	(1) Mould (Baby)	(2) Mould (Baby)	(3) Mould (Baby)	(4) Mould (Baby)	(5) Mould (Baby)	(6) Mould (Baby)
Damp (House)	6.212***	4.790***	4.650***			
	(22.40)	(14.74)	(14.37)			
Unheated (House)	1.850***	1.242	1.215			
	(5.52)	(1.32)	(1.11)			
Crowded (>2 ppl per bedroom)	1.992***	1.710***	1.637***	1.944***	1.578***	1.514***
	(6.56)	(3.61)	(3.19)	(6.37)	(3.12)	(2.72)
Damp (Baby Room)				6.317***	4.899***	4.893***
				(22.49)	(15.28)	(15.09)
Unheated (Baby)				1.757***	1.336**	1.284**
				(6.40)	(2.41)	(2.02)
Winter Interview	1.075	1.134	1.130	0.986	1.057	1.055
	(0.85)	(1.18)	(1.13)	(-0.17)	(0.51)	(0.48)
Household Income -- omitted >$150K						
<=30K		1.296	1.281		1.154	1.135
		(1.03)	(0.97)		(0.57)	(0.49)
>30K <=50K		1.227	1.231		1.158	1.168
		(0.88)	(0.88)		(0.62)	(0.65)
>50 <=70K		1.140	1.130		1.144	1.125
		(0.59)	(0.54)		(0.60)	(0.52)
>70K <=100K		0.859	0.852		0.827	0.820
		(-0.67)	(-0.70)		(-0.83)	(-0.87)
>100K <=150K		0.866	0.859		0.842	0.841
		(-0.60)	(-0.63)		(-0.71)	(-0.72)
Housing Tenure -- omitted 'Own'						
Private Rental		1.381***	1.333**		1.534***	1.456***
		(2.69)	(2.33)		(3.58)	(3.03)
Public Rental		2.056***	1.888***		2.179***	1.953***
		(3.46)	(2.98)		(3.71)	(3.11)
Other Rental		0.633	0.613		0.691	0.651
		(-1.51)	(-1.59)		(-1.27)	(-1.45)
Mother Smokes		1.112	1.052		1.043	0.956
		(0.58)	(0.28)		(0.23)	(-0.25)
Other Smokers in HH		1.066	1.031		1.128	1.087
		(0.46)	(0.22)		(0.88)	(0.60)
Asthma ever (Mother)		0.961	0.927		0.963	0.919
		(-0.34)	(-0.62)		(-0.31)	(-0.69)
BMI (Mother Pre-pregnancy)		1.007	1.001		1.010	1.003
		(0.81)	(0.11)		(1.15)	(0.30)
General Health, Mother Pre-pregnancy -- omitted 'Poor Health'						
Fair		1.231	1.225		1.457	1.462
		(0.61)	(0.60)		(1.09)	(1.11)
Good		0.861	0.885		1.079	1.135
		(-0.47)	(-0.39)		(0.24)	(0.40)
Very good		0.888	0.919		1.087	1.140
		(-0.37)	(-0.26)		(0.26)	(0.40)
Excellent		0.912	0.949		1.088	1.155
		(-0.27)	(-0.16)		(0.25)	(0.42)
Partnered (Mother)			1.191			1.174
			(0.87)			(0.80)
Age (Mother Antenatal)			0.993			0.988
			(-0.68)			(-1.13)
Preferred Ethnicity (Mother) -- omitted NZ/European						
Maori			1.521***			1.575***
			(2.69)			(2.92)
Pacific			1.277			1.306
			(1.32)			(1.49)
Asian			0.845			0.759
			(-1.00)			(-1.62)
Other			1.488			1.364
			(1.45)			(1.12)
Observations	6444	4606	4602	6444	4606	4602
Pseudo R-squared	0.138	0.130	0.134	0.144	0.135	0.141

Coefficients are odds ratios; t statistics in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Table 10. Logistic Regression of Household Crowding, Antenatal Survey

Variable	(1) Crowded (>=2 ppl per BR)	(2) Crowded (>=2 ppl per BR)	(3) Crowded (>=2 ppl per BR)	(4) Crowded (>=2 ppl per BR)	(1A) Crowded (>2 ppl per BR)	(2A) Crowded (>2 ppl per BR)	(3A) Crowded (>2 ppl per BR)	(4A) Crowded (>2 ppl per BR)
Mother Age Category -- omitted 35+								
<=20 years	3.024***	1.375*	1.873***	1.301	3.222***	1.470	2.135***	1.442
	(8.89)	(1.69)	(3.25)	(1.32)	(6.97)	(1.48)	(2.84)	(1.36)
21-25 years	1.940***	0.863	1.002	0.868	1.984***	1.019	1.233	1.055
	(6.71)	(-1.08)	(0.01)	(-1.02)	(4.88)	(0.10)	(1.07)	(0.28)
26-30 years	1.440***	0.954	0.964	0.877	1.508***	1.160	1.185	1.106
	(4.01)	(-0.42)	(-0.33)	(-1.15)	(3.13)	(0.92)	(1.04)	(0.61)
Partnered	1.160	2.292***	1.869**	1.972***	0.820	1.090	0.859	0.908
	(0.92)	(3.37)	(2.48)	(2.64)	(-0.98)	(0.30)	(-0.51)	(-0.32)
Housing Tenure -- omitted 'Own'								
Private Rental		2.006***	1.905***	1.643***		1.184	1.112	0.836
		(6.16)	(5.71)	(4.23)		(0.99)	(0.62)	(-1.03)
Public Rental		5.232***	5.046***	2.433***		4.694***	4.463***	1.711**
		(9.96)	(9.59)	(4.97)		(7.07)	(6.80)	(2.38)
Other Rental		0.744	0.819	0.936		0.636	0.717	0.776
		(-1.08)	(-0.72)	(-0.23)		(-1.13)	(-0.83)	(-0.61)
Household Income -- omitted >$150K								
<=30		5.861***	4.849***	2.834***		4.506***	3.536***	1.875*
		(7.19)	(6.37)	(4.10)		(4.06)	(3.39)	(1.67)
>30K <=50K		5.453***	4.639***	2.808***		5.301***	4.337***	2.343**
		(7.28)	(6.53)	(4.29)		(4.84)	(4.23)	(2.40)
>50 <=70K		3.258***	2.867***	1.918***		3.363***	2.854***	1.770
		(5.13)	(4.54)	(2.72)		(3.62)	(3.10)	(1.63)
>70K <=100K		2.306***	2.186***	1.649**		1.952**	1.827*	1.305
		(3.72)	(3.47)	(2.18)		(1.99)	(1.78)	(0.77)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
>100K <=150K		1.419	1.366	1.202		0.905	0.860	0.724
		(1.49)	(1.32)	(0.77)		(-0.27)	(-0.40)	(-0.85)
Immigrant			2.200***	1.452***			2.449***	2.012***
			(8.39)	(2.84)			(6.46)	(3.64)
Preferred Ethnicity (Mother) -- omitted NZ/European								
Maori				4.563***				9.993***
				(9.54)				(8.27)
Pacific				9.962***				16.62***
				(15.55)				(10.97)
Asian				3.660***				3.618***
				(7.85)				(4.47)
Other				2.760***				4.635***
				(3.45)				(3.49)
Observations	6234	5243	5243	5238	6234	5243	5243	5238
Pseudo R-squared	0.019	0.115	0.134	0.208	0.020	0.109	0.129	0.222

Coefficients are odds ratios; t statistics in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Table 11. Logistic Regression of Household Crowding, 9-month survey

Variable	(1) Crowded (>=2 ppl per BR)	(2) Crowded (>=2 ppl per BR)	(3) Crowded (>=2 ppl per BR)	(4) Crowded (>=2 ppl per BR)	(5) Crowded (>=2 ppl per BR)	(1A) Crowded (>2 ppl per BR)	(2A) Crowded (>2 ppl per BR)	(3A) Crowded (>2 ppl per BR)	(4A) Crowded (>2 ppl per BR)	(5A) Crowded (>2 ppl per BR)
Crowded previous survey	12.29***	11.79***	8.934***	8.215***	5.773***	14.91***	13.90***	9.816***	8.960***	5.526***
	(29.02)	(27.83)	(19.49)	(18.23)	(14.54)	(22.60)	(21.15)	(13.79)	(12.93)	(9.80)
Mother Age Category -- omitted 35+										
<=20 years		1.721***	0.846	1.060	0.845		2.834***	0.961	1.258	0.979
		(3.05)	(-0.68)	(0.24)	(-0.69)		(5.50)	(-0.14)	(0.78)	(-0.07)
21-25 years		1.763***	1.119	1.270*	1.028		1.881***	1.085	1.266	1.010
		(5.53)	(0.87)	(1.82)	(0.21)		(5.05)	(0.51)	(1.47)	(0.06)
26-30 years		1.220**	0.909	0.914	0.791**		1.301**	0.921	0.939	0.826
		(2.27)	(-0.92)	(-0.86)	(-2.20)		(2.35)	(-0.60)	(-0.45)	(-1.38)
Partnered		0.860	1.199	1.077	1.175		1.258	1.531**	1.367	1.527*
		(-1.07)	(1.02)	(0.41)	(0.86)		(1.32)	(2.02)	(1.47)	(1.94)
Housing Tenure -- omitted 'Own'										
Private Rental			1.583***	1.478***	1.352***			1.576***	1.458***	1.244
			(4.72)	(4.00)	(2.98)			(3.44)	(2.83)	(1.60)
Public Rental			4.998***	4.726***	2.765***			4.597***	4.244***	2.168***
			(9.40)	(8.90)	(5.35)			(8.01)	(7.48)	(3.70)
Other Rental			1.235	1.288	1.359			0.714	0.752	0.785
			(1.02)	(1.21)	(1.39)			(-1.01)	(-0.86)	(-0.69)
Household Income -- omitted >$150K										
<=30			4.259***	4.083***	3.096***			5.163***	4.853***	3.174***
			(5.47)	(5.33)	(4.32)			(4.57)	(4.38)	(3.21)
>30K <=50K			5.583***	5.393***	4.212***			5.471***	5.137***	3.407***
			(7.10)	(6.99)	(5.97)			(5.02)	(4.79)	(3.58)
>50 <=70K			3.785***	3.702***	3.014***			3.520***	3.411***	2.408**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			(5.58)	(5.51)	(4.66)			(3.73)	(3.61)	(2.57)
>70K <=100K			2.650***	2.589***	2.314***			2.134**	2.067**	1.690
			(4.09)	(4.01)	(3.57)			(2.21)	(2.10)	(1.52)
>100K <=150K			1.350	1.333	1.179			1.127	1.122	0.925
			(1.16)	(1.12)	(0.64)			(0.31)	(0.30)	(-0.20)
Immigrant				2.023***	1.354**				2.098***	1.410**
				(8.02)	(2.49)				(6.59)	(2.24)
Preferred Ethnicity (Mother) -- omitted NZ/European										
Maori					3.456***					4.883***
					(9.46)					(8.40)
Pacific					6.035***					8.689***
					(13.26)					(11.80)
Asian					3.511***					4.377***
					(8.62)					(7.48)
Other					2.143***					2.169**
					(2.91)					(2.14)
Observations	5822	5812	4967	4967	4961	5822	5812	4967	4967	4961
Pseudo R-squared	0.151	0.160	0.218	0.231	0.278	0.118	0.131	0.191	0.205	0.263

Coefficients are odds ratios; t statistics in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Table 12. Logistic Regression of Chest Illness in the first 9-months

Variable	(1) Chest (Y/N)	(2) Chest (Y/N)	(3) Chest (Y/N)	(4) Chest (Y/N)	(5) Chest (Y/N)	(6) Chest (Y/N)	(7) Chest (Y/N)	(8) Chest (Y/N)	(9) Chest (Y/N)	(10) Chest (Y/N)	(11) Chest (Y/N)	(12) Chest (Y/N)
Damp (House)	1.450***	1.363***	1.341***	1.326***		1.257***	1.251***	1.226**			1.168*	1.131
	(0.0961)	(0.0961)	(0.0948)	(0.0945)		(0.106)	(0.106)	(0.104)			(0.109)	(0.107)
Mould (Baby Room)		1.298***	1.251***	1.233**		1.241**	1.230**	1.250**			1.193	1.141
		(0.111)	(0.108)	(0.107)		(0.125)	(0.126)	(0.128)			(0.136)	(0.131)
Unheated (House)			1.447***	1.407***		1.307**	1.280**	1.283**			1.208	1.178
			(0.126)	(0.126)		(0.147)	(0.145)	(0.147)			(0.162)	(0.167)
Crowded (>2 ppl per bedroom)				1.149	1.133	0.972	0.933	0.962	0.925	0.947	0.972	0.957
				(0.102)	(0.101)	(0.111)	(0.107)	(0.111)	(0.106)	(-0.38)	(0.129)	(0.136)
Housing Condition PC1					1.151***				1.121***	1.076**		
					(0.0231)				(0.0294)	(2.41)		
Housing Condition PC2					1.009				0.991	0.982		
					(0.0225)				(0.0270)	(-0.56)		
Household Income -- omitted >$150K												
<=30K						1.058	0.907	0.946	0.898	0.941	0.858	0.950
						(0.156)	(0.138)	(0.146)	(0.137)	(-0.36)	(0.140)	(0.159)
>30K <=50K						0.872	0.822	0.847	0.813	0.784	0.722**	0.793
						(0.118)	(0.113)	(0.118)	(0.112)	(-1.63)	(0.105)	(0.118)
>50 <=70K						0.835	0.794*	0.804	0.788*	0.777*	0.724**	0.784*
						(0.108)	(0.104)	(0.107)	(0.103)	(-1.82)	(0.0985)	(0.109)
>70K <=100K						0.881	0.869	0.906	0.863	0.867	0.824	0.873
						(0.111)	(0.110)	(0.116)	(0.109)	(-1.09)	(0.107)	(0.114)
>100K <=150K						0.955	0.945	0.966	0.942	0.924	0.898	0.927
						(0.125)	(0.125)	(0.129)	(0.124)	(-0.59)	(0.120)	(0.125)
Housing Tenure -- omitted 'Own'												
Private Rental						1.101	1.052	1.070	1.054	1.036	1.033	1.039
						(0.0837)	(0.0811)	(0.0830)	(0.0811)	(0.42)	(0.0846)	(0.0876)
Public Rental						1.694***	1.526***	1.522***	1.522***	1.142	1.354*	1.149
						(0.243)	(0.222)	(0.223)	(0.221)	(0.74)	(0.237)	(0.205)
Other Rental						1.150	1.085	1.120	1.081	1.040	1.074	1.047
						(0.186)	(0.178)	(0.183)	(0.177)	(0.23)	(0.188)	(0.183)
Gestational Age												
Term (37-41 GW)						0.755*	0.735**	0.775*	0.733**	0.855	0.790	0.857
						(0.114)	(0.112)	(0.119)	(0.112)	(-0.96)	(0.127)	(0.140)
PostTerm (>41 GW)						0.700	0.674	0.727	0.667	0.747	0.669	0.752
						(0.181)	(0.175)	(0.193)	(0.173)	(-1.02)	(0.186)	(0.214)
Male (Child)						1.375***	1.363***	1.365***	1.363***	1.000	1.435***	1.460***
						(0.0895)	(0.0894)	(0.0902)	(0.0894)	(-0.45)	(0.101)	(0.103)
Age (Child at 9m Survey)						1.009	1.008	1.008	1.009	1.460***	1.005	1.003
						(0.0108)	(0.0110)	(0.0111)	(0.0109)	(5.34)	(0.0122)	(0.0123)
Winter Interview=1						0.867**	0.869*	0.871*	0.863**	0.893	0.892	0.902
						(0.0621)	(0.0626)	(0.0633)	(0.0623)	(-1.46)	(0.0685)	(0.0701)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Number GUiNZ Children Born						1.507**	1.491*	1.508**	1.475*	1.378	1.514*	1.390
						(0.310)	(0.307)	(0.310)	(0.303)	(1.47)	(0.327)	(0.303)
VX Birth							1.117*		1.119*	1.132*	1.103	1.129*
							(0.0748)		(0.0749)	(1.70)	(0.0793)	(0.0824)
VX 6w							1.205		1.212	1.405	1.438	1.409
							(0.451)		(0.453)	(0.79)	(0.614)	(0.610)
Vx 3m							1.222		1.211	1.036	1.039	1.039
							(0.295)		(0.291)	(0.14)	(0.260)	(0.264)
VX 5m							0.674***		0.679***	0.773*	0.704**	0.770*
							(0.0925)		(0.0929)	(-1.70)	(0.107)	(0.117)
No VX @ 9m							0.754		0.762	0.808	0.792	0.807
							(0.319)		(0.322)	(-0.45)	(0.373)	(0.382)
All VX Given 6w 3m 5m								0.986		0.893		
								(0.101)		(-1.46)		
Mother Smokes						1.739***	1.764***	1.733***		1.500***	1.755***	1.504***
						(0.206)	(0.210)	(0.205)		(2.97)	(0.234)	(0.205)
Other Smokers in HH						1.027	1.030	1.027		0.903	0.934	0.902
						(0.0976)	(0.0988)	(0.0975)		(-0.93)	(0.0984)	(0.0984)
Asthma ever (Mother)										1.254***	1.335***	1.257***
										(2.83)	(0.106)	(0.101)
BMI (Mother Pre-pregnancy)										1.020***	1.036***	1.021***
										(3.25)	(0.00614)	(0.00637)
General Health, Mother Pre-pregnancy -- omitted 'Poor Health'												
Fair										0.690	0.692	0.690
										(-1.28)	(0.194)	(0.200)
Good										0.635*	0.628*	0.630*
										(-1.69)	(0.163)	(0.170)
Very good										0.639*	0.676	0.634*
										(-1.65)	(0.176)	(0.172)
Excellent										0.555**	0.612*	0.552**
										(-2.11)	(0.163)	(0.154)
Age (Mother Antenatal)										1.005		1.006
										(0.73)		(0.00725)
Preferred Ethnicity (Mother) -- omitted NZ/European												
Maori										1.390***		1.394***
										(2.92)		(0.157)
Pacific										1.559***		1.551***
										(3.27)		(0.212)
Asian										0.381***		0.382***
										(-6.77)		(0.0543)
Other										0.943		0.954
										(-0.24)		(0.238)
Observations	6460	6447	6444	6441	6441	5068	5062	4960	5062	4590	4594	4590
Pseudo R-squared	0.004	0.006	0.008	0.008	0.008	0.018	0.026	0.024	0.026	0.052	0.036	0.052

Coefficients are odds ratios; Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 13. Logistic Regression of Chest Illness in the first 9 months, Restricted to Same Sample

Variable	(1) Chest (Y/N)	(2) Chest (Y/N)	(3) Chest (Y/N)	(4) Chest (Y/N)	(5) Chest (Y/N)	(6) Chest (Y/N)	(7) Chest (Y/N)	(8) Chest (Y/N)	(9) Chest (Y/N)	(10) Chest (Y/N)	(11) Chest (Y/N)
Damp (House)	1.337***	1.260***	1.252**	1.242**		1.219**	1.214**	1.186*		1.165	1.131
	(3.46)	(2.64)	(2.56)	(2.45)		(2.17)	(2.12)	(1.85)		(1.64)	(1.30)
Mould (Baby Room)		1.285**	1.264**	1.252**		1.209*	1.195	1.209*		1.184	1.141
		(2.32)	(2.16)	(2.06)		(1.71)	(1.58)	(1.68)		(1.48)	(1.15)
Unheated (House)			1.374***	1.351**		1.22	1.206	1.192		1.206	1.178
			(2.58)	(2.41)		(1.53)	(1.42)	(1.33)		(1.39)	(1.16)
Crowded (>2 ppl per bedroom)				1.118	1.093	1.029	1.001	1.036	0.989	0.972	0.957
				(0.90)	(0.71)	(0.22)	(0.01)	(0.28)	(-0.08)	(-0.22)	(-0.31)
Housing Condition PC1					1.140***				1.106***		
					(4.88)				(3.44)		
Housing Condition PC2					1.003				0.982		
					(0.09)				(-0.59)		
Household Income -- omitted >$150K											
<=30						1.077	0.928	0.968	0.916	0.863	0.95
						-0.48	(-0.46)	(-0.20)	(-0.54)	(-0.90)	(-0.31)
>30K <=50K						0.82	0.775*	0.808	0.766*	0.723**	0.793
						(-1.40)	(-1.78)	(-1.47)	(-1.86)	(-2.23)	(-1.56)
>50 <=70K						0.817	0.781*	0.798*	0.774*	0.724**	0.784*
						(-1.52)	(-1.84)	(-1.65)	(-1.91)	(-2.37)	(-1.75)
>70K <=100K						0.878	0.861	0.906	0.855	0.822	0.873
						(-1.02)	(-1.16)	(-0.76)	(-1.22)	(-1.51)	(-1.04)
>100K <=150K						0.935	0.923	0.952	0.92	0.9	0.927
						(-0.51)	(-0.60)	(-0.37)	(-0.62)	(-0.79)	(-0.56)
Housing Tenure -- omitted 'Own'											
Private Rental						1.081	1.041	1.061	1.04	1.034	1.039
						(0.97)	(0.50)	(0.72)	(0.48)	(0.41)	(0.45)
Public Rental						1.720***	1.542**	1.532**	1.530**	1.355*	1.149
						(3.22)	(2.54)	(2.47)	(2.49)	(1.73)	(0.77)
Other Rental						1.168	1.103	1.148	1.097	1.074	1.047
						(0.93)	(0.58)	(0.82)	(0.55)	(0.41)	(0.27)
Gestational Age											
Term (37-41 GW)						0.750*	0.723**	0.757*	0.722**	0.79	0.857
						(-1.82)	(-2.03)	(-1.72)	(-2.04)	(-1.47)	(-0.94)
PostTerm (>41 GW)						0.635*	0.621*	0.667	0.616*	0.669	0.752
						(-1.65)	(-1.72)	(-1.44)	(-1.75)	(-1.45)	(-1.00)
Birthweight (Child)						1.000*	1.000**	1.000*	1.000**	1	1
						(1.93)	(2.10)	(1.90)	(2.04)	(0.87)	(0.41)
Male (Child)						1.421***	1.407***	1.417***	1.407***	1.435***	1.460***
						(5.08)	(4.90)	(4.96)	(4.90)	(5.14)	(5.34)
Age (Child at 9m Survey)						1.007	1.006	1.006	1.006	1.005	1.003
						(0.60)	(0.48)	(0.47)	(0.48)	(0.45)	(0.28)

Winter Interview=1						0.883	0.885	0.882	0.877*	0.89	0.902
						(-1.63)	(-1.60)	(-1.63)	(-1.71)	(-1.51)	(-1.33)
Number GUiNZ Children Born						1.610**	1.563**	1.587**	1.544**	1.514*	1.39
						(2.19)	(2.06)	(2.13)	(2.00)	(1.92)	(1.51)
VX Birth						1.095		1.097	1.106	1.129*	
						(1.28)		(1.30)	(1.41)	(1.66)	
VX 6w						1.347		1.341	1.441	1.409	
						(0.71)		(0.70)	(0.85)	(0.79)	
Vx 3m						1.106		1.102	1.038	1.039	
						(0.40)		(0.39)	(0.15)	(0.15)	
VX 5m						0.689**		0.692**	0.704**	0.770*	
						(-2.51)		(-2.49)	(-2.32)	(-1.73)	
No VX @ 9m						0.743		0.744	0.794	0.807	
						(-0.64)		(-0.64)	(-0.49)	(-0.45)	
All VX Given 6w 3m 5m							1.013				
							-0.12				
Mother Smokes						1.834***	1.876***	1.826***	1.754***	1.504***	
						(4.61)	(4.75)	(4.58)	(4.21)	(2.99)	
Other Smokers in HH						0.968	0.965	0.967	0.934	0.902	
						(-0.32)	(-0.33)	(-0.32)	(-0.65)	(-0.94)	
Asthma ever (Mother)										1.334***	1.257***
										(3.64)	(2.86)
BMI (Mother Pre-pregnancy)										1.036***	1.021***
										(5.92)	(3.29)
General Health, Mother Pre-pregnancy -- omitted 'Poor Health'											
Fair										0.693	0.69
										(-1.31)	(-1.28)
Good										0.628*	0.630*
										(-1.79)	(-1.71)
Very good										0.677	0.634*
										(-1.50)	(-1.68)
Excellent										0.613*	0.552**
										(-1.83)	(-2.13)
Age (Mother Antenatal)											1.006
											(0.78)
Preferred Ethnicity (Mother) -- omitted NZ/European											
Maori											1.394***
											(2.95)
Pacific											1.551***
											(3.21)
Asian											0.382***
											(-6.77)
Other											0.954
											(-0.19)
Observations	4590	4590	4590	4590	4590	4590	4590	4498	4590	4590	4590
Pseudo R-squared	0.002	0.003	0.004	0.005	0.005	0.016	0.024	0.022	0.025	0.036	0.052

Coefficients are odds ratios; t statistics in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 14. Ordered Logit of Number of Chest Illnesses in the first 9 months

Variable	(1) Chest (N Illness)	(2) Chest (N Illness)	(3) Chest (N Illness)	(4) Chest (N Illness)	(5) Chest (N Illness)	(6) Chest (N Illness)	(7) Chest (N Illness)	(8) Chest (N Illness)	(9) Chest (N Illness)	(10) Chest (N Illness)	(11) Chest (N Illness)
Damp (House)	1.477***	1.388***	1.363***	1.347***		1.284***	1.280***	1.251***		1.201*	1.167
	(5.87)	(4.65)	(4.38)	(4.17)		(2.92)	(2.88)	(2.59)		(1.94)	(1.61)
Mould (Baby Room)		1.303***	1.254***	1.237**		1.231**	1.216*	1.233**		1.198	1.148
		(3.11)	(2.63)	(2.46)		(2.07)	(1.91)	(2.03)		(1.57)	(1.19)
Unheated (House)			1.454***	1.416***		1.310**	1.292**	1.297**		1.215	1.187
			(4.29)	(3.90)		(2.40)	(2.25)	(2.26)		(1.43)	(1.20)
Crowded (>2 ppl per bedroom)				1.142	1.124	0.957	0.914	0.946	0.905	0.948	0.931
				(1.50)	(1.32)	(-0.39)	(-0.79)	(-0.48)	(-0.87)	(-0.41)	(-0.50)
Housing Condition PC1					1.157***				1.126***		
					(7.30)				(4.53)		
Housing Condition PC2					1.009				0.992		
					(0.38)				(-0.31)		
Household Income -- omitted >$150K											
<=30						1.102	0.937	0.982	0.927	0.882	0.977
						(0.66)	(-0.43)	(-0.12)	(-0.50)	(-0.78)	(-0.14)
>30K <=50K						0.883	0.828	0.854	0.820	0.734**	0.808
						(-0.93)	(-1.39)	(-1.15)	(-1.45)	(-2.15)	(-1.45)
>50 <=70K						0.858	0.814	0.824	0.809	0.741**	0.805
						(-1.19)	(-1.58)	(-1.47)	(-1.63)	(-2.21)	(-1.57)
>70K <=100K						0.895	0.879	0.919	0.873	0.834	0.887
						(-0.90)	(-1.04)	(-0.67)	(-1.09)	(-1.42)	(-0.93)
>100K <=150K						0.965	0.956	0.981	0.952	0.909	0.937
						(-0.27)	(-0.35)	(-0.15)	(-0.38)	(-0.72)	(-0.49)
Housing Tenure -- omitted 'Own'											
Private Rental						1.105	1.055	1.074	1.057	1.037	1.043
						(1.32)	(0.70)	(0.92)	(0.72)	(0.45)	(0.50)
Public Rental						1.658***	1.494***	1.479***	1.491***	1.345*	1.153
						(3.55)	(2.79)	(2.71)	(2.77)	(1.69)	(0.80)
Other Rental						1.136	1.073	1.104	1.071	1.045	1.017
						(0.80)	(0.44)	(0.61)	(0.43)	(0.26)	(0.10)
Gestational Age											
Term (37-41 GW)						0.767*	0.749*	0.785	0.748*	0.798	0.863
						(-1.80)	(-1.93)	(-1.59)	(-1.94)	(-1.42)	(-0.92)
PostTerm (>41 GW)						0.699	0.680	0.713	0.674	0.661	0.740
						(-1.41)	(-1.52)	(-1.31)	(-1.55)	(-1.53)	(-1.08)
Birthweight (Child)						1.000	1.000	1.000	1.000	1.000	1.000
						(1.23)	(1.42)	(1.25)	(1.36)	(0.63)	(-0.61)
Male (Child)						1.403***	1.396***	1.394***	1.395***	1.460***	1.489***
						(5.24)	(5.11)	(5.06)	(5.11)	(5.43)	(5.67)
Age (Child at 9m Survey)						1.013	1.013	1.013	1.013	1.009	1.008
						(1.17)	(1.09)	(1.10)	(1.12)	(0.68)	(0.63)

Winter Interview						0.867**	0.868**	0.871*	0.861**	0.889	0.899
						(-1.99)	(-1.98)	(-1.91)	(-2.07)	(-1.53)	(-1.37)
Number GUiNZ Children Born						1.494**	1.472*	1.484**	1.452*	1.458*	1.337
						(2.00)	(1.92)	(1.97)	(1.86)	(1.81)	(1.39)
VX Birth						1.112		1.114		1.096	1.120
						(1.60)		(1.62)		(1.29)	(1.56)
VX 6w						1.254		1.260		1.490	1.476
						(0.63)		(0.65)		(0.96)	(0.93)
Vx 3m						1.317		1.307		1.098	1.095
						(1.13)		(1.11)		(0.36)	(0.35)
VX 5m						0.633***		0.637***		0.661**	0.727**
						(-3.16)		(-3.12)		(-2.57)	(-1.97)
No VX @ 9m						0.808		0.816		0.817	0.843
						(-0.52)		(-0.49)		(-0.44)	(-0.37)
All VX Given 6w 3m 5m							0.958				
							(-0.41)				
Mother Smokes						1.778***	1.801***	1.770***		1.789***	1.520***
						(4.87)	(4.94)	(4.84)		(4.33)	(3.04)
Other Smokers in HH						1.038	1.041	1.038		0.945	0.915
						(0.40)	(0.42)	(0.39)		(-0.53)	(-0.81)
Asthma ever (Mother)										1.376***	1.293***
										(4.01)	(3.19)
BMI (Mother Pre-pregnancy)										1.034***	1.019***
										(5.87)	(3.15)
General Health, Mother Pre-pregnancy -- omitted 'Poor Health'											
Fair										0.631	0.625
										(-1.60)	(-1.57)
Good										0.574**	0.575**
										(-2.08)	(-1.99)
Very good										0.625*	0.585*
										(-1.76)	(-1.91)
Excellent										0.567**	0.510**
										(-2.07)	(-2.34)
Age (Mother Antenatal)											1.006
											(0.78)
Preferred Ethnicity (Mother) -- omitted NZ/European											
Maori											1.421***
											(3.06)
Pacific											1.512***
											(3.01)
Asian											0.378***
											(-6.88)
Other											0.955
											(-0.18)
Observations	6460	6447	6444	6441	6441	5068	5062	4960	5062	4594	4590
Pseudo R-squared	0.004	0.005	0.007	0.007	0.007	0.016	0.024	0.021	0.024	0.032	0.046

Coefficients are odds ratios; t statistics in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 15. Logistic Regression Results (Key Variables) for Chest Illness in the First 9-months Using Dampness in the Baby's Room

Variable	(1) Chest (Y/N)	(2) Chest (Y/N)	(3) Chest (Y/N)	(4) Chest (Y/N)	(5) Chest (Y/N)	(6) Chest (Y/N)	(7) Chest (Y/N)	(8) Chest (Y/N)	(9) Chest (Y/N)	(10) Chest (Y/N)	(11) Chest (Y/N)	(12) Chest (Y/N)
Damp (Baby Room)	1.311*** (4.13)	1.219*** (2.82)	1.207*** (2.67)	1.191** (2.46)		1.177* (1.94)	1.178* (1.94)	1.187** (2.02)			1.183* (1.84)	1.203** (1.99)
Mould (Baby Room)		1.356*** (3.55)	1.302*** (3.04)	1.283*** (2.85)		1.264** (2.31)	1.249** (2.14)	1.258** (2.21)			1.184 (1.47)	1.115 (0.93)
Unheated (House)			1.464*** (4.39)	1.420*** (3.93)		1.310** (2.40)	1.282** (2.19)	1.287** (2.20)			1.214 (1.44)	1.189 (1.23)
Crowded (>2 ppl per bedroom)				1.164* (1.71)	1.133 (1.40)	0.973 (-0.24)	0.934 (-0.60)	0.960 (-0.36)	0.925 (-0.68)	0.947 (-0.38)	0.965 (-0.27)	0.946 (-0.39)
Housing Condition PC1					1.151*** (7.00)				1.121*** (4.36)	1.076** (2.41)		
Housing Condition PC2					1.009 (0.41)				0.991 (-0.33)	0.982 (-0.56)		
Observations	6460	6447	6444	6441	6441	5068	5062	4960	5062	4590	4594	4590
Pseudo R-squared	0.004	0.006	0.008	0.008	0.008	0.018	0.026	0.024	0.026	0.052	0.036	0.052

Restricted Sample Results

Variable	(1) Chest (Y/N)	(2) Chest (Y/N)	(3) Chest (Y/N)	(4) Chest (Y/N)	(5) Chest (Y/N)	(6) Chest (Y/N)	(7) Chest (Y/N)	(8) Chest (Y/N)	(9) Chest (Y/N)	(10) Chest (Y/N)	(11) Chest (Y/N)	(12) Chest (Y/N)
Damp (Baby Room)	1.325*** (3.44)	1.251*** (2.61)	1.249*** (2.59)	1.238** (2.47)		1.214** (2.16)	1.213** (2.14)	1.221** (2.20)			1.178* (1.80)	1.203** (1.99)
Mould (Baby Room)		1.285** (2.31)	1.262** (2.12)	1.251** (2.03)		1.206* (1.67)	1.190 (1.52)	1.192 (1.54)			1.175 (1.40)	1.115 (0.93)
Unheated (House)			1.383*** (2.63)	1.361** (2.47)		1.227 (1.57)	1.212 (1.46)	1.200 (1.38)			1.211 (1.43)	1.189 (1.23)
Crowded (>2 ppl per bedroom)				1.112 (0.85)	1.093 (0.71)	1.023 (0.18)	0.995 (-0.04)	1.027 (0.20)	0.989 (-0.08)	0.947 (-0.38)	0.966 (-0.26)	0.946 (-0.39)
Housing Condition PC1					1.140*** (4.88)				1.106*** (3.44)	1.076** (2.41)		
Housing Condition PC2					1.003 (0.09)				0.982 (-0.59)	0.982 (-0.56)		
Observations	4590	4590	4590	4590	4590	4590	4590	4498	4590	4590	4590	4590
Pseudo R-squared	0.002	0.003	0.004	0.005	0.005	0.016	0.024	0.022	0.025	0.052	0.036	0.052

Coefficients are odds ratios; t statistics in parentheses
* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 16. Ordered Logistic Regression Results (Key Variables) for Doctor Visits and Hospital Admissions for Chest Illness in the First 9-months

Variable	(1) Chest (N Illness)	(2) Chest (N Illness)	(3) Chest (N Illness)	(4) Chest (N Illness)	(5) Chest (N Illness)	(6) Chest (N Illness)	(7) Chest (N Illness)	(8) Chest (N Illness)	(9) Chest (N Illness)	(10) Chest (N Illness)	(11) Chest (N Illness)
Ordered Logit Regression of Number of Chest Illnesses											
Damp (Baby Room)	1.326***	1.231***	1.216***	1.200***		1.181**	1.183**	1.192**		1.191*	1.211**
	(4.30)	(2.98)	(2.80)	(2.58)		(1.99)	(2.00)	(2.07)		(1.92)	(2.06)
Mould (Baby Room)		1.366***	1.309***	1.290***		1.261**	1.242**	1.247**		1.196	1.129
		(3.66)	(3.12)	(2.93)		(2.29)	(2.09)	(2.12)		(1.54)	(1.03)
Unheated (House)			1.473***	1.430***		1.313**	1.294**	1.301**		1.220	1.197
			(4.45)	(4.02)		(2.42)	(2.27)	(2.29)		(1.46)	(1.26)
Crowded (>2 ppl per bedroom)				1.159*	1.124	0.961	0.917	0.947	0.905	0.943	0.922
				(1.67)	(1.32)	(-0.35)	(-0.75)	(-0.47)	(-0.87)	(-0.44)	(-0.57)
Housing Condition PC1					1.157***				1.126***		
					(7.30)				(4.53)		
Housing Condition PC2					1.009				0.992		
					(0.38)				(-0.31)		
Observations	6460	6447	6444	6441	6441	5068	5062	4960	5062	4594	4590
Pseudo R-squared	0.002	0.004	0.006	0.006	0.007	0.015	0.023	0.021	0.024	0.032	0.046

Ordered Logistic Regression of Number of Doctor Visits

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Damp (Baby Room)	1.313***	1.211***	1.195**	1.178**		1.139	1.141	1.148		1.162	1.178*
	(4.11)	(2.72)	(2.53)	(2.30)		(1.54)	(1.55)	(1.61)		(1.63)	(1.74)
Mould (Baby Room)		1.401***	1.339***	1.318***		1.322***	1.306**	1.308***		1.223*	1.153
		(3.95)	(3.37)	(3.17)		(2.75)	(2.57)	(2.58)		(1.73)	(1.21)
Unheated (House)			1.510***	1.462***		1.272**	1.249*	1.250*		1.176	1.143
			(4.68)	(4.22)		(2.12)	(1.93)	(1.93)		(1.19)	(0.93)
Crowded (>2 ppl per bedroom)				1.173*	1.136	0.939	0.894	0.921	0.881	0.914	0.887
				(1.81)	(1.44)	(-0.55)	(-0.98)	(-0.71)	(-1.10)	(-0.68)	(-0.85)
Housing Condition PC1					1.161***				1.122***		
					(7.41)				(4.40)		
Housing Condition PC2					1.015				0.986		
					(0.66)				(-0.50)		
Observations	6460	6447	6444	6441	6441	5068	5062	4960	5062	4594	4590
Pseudo R-squared	0.002	0.004	0.006	0.006	0.007	0.014	0.022	0.020	0.023	0.029	0.041

Ordered Logistic Regression of Number of Hospital Admissions

Variable	(1) Chest (Hosp Admits)	(2) Chest (Hosp Admits)	(3) Chest (Hosp Admits)	(4) Chest (Hosp Admits)	(5) Chest (Hosp Admits)	(6) Chest (Hosp Admits)	(7) Chest (Hosp Admits)	(8) Chest (Hosp Admits)	(9) Chest (Hosp Admits)	(10) Chest (Hosp Admits)	(11) Chest (Hosp Admits)
Damp (Baby Room)	1.518***	1.387**	1.353**	1.253		1.190	1.197	1.196		1.281	1.272
	(3.26)	(2.42)	(2.21)	(1.60)		(1.00)	(1.03)	(1.02)		(1.23)	(1.16)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Mould (Baby Room)		1.407**	1.270	1.184		1.116	1.088	1.060		1.038	0.949
		(2.13)	(1.45)	(1.01)		(0.54)	(0.41)	(0.28)		(0.15)	(-0.21)
Unheated (House)			2.164***	1.856***		1.333	1.291	1.340		1.002	0.820
			(5.21)	(3.96)		(1.41)	(1.24)	(1.43)		(0.01)	(-0.69)
Crowded (>2 ppl per bedroom)				1.965***	1.906***	1.360	1.295	1.338	1.295	1.110	0.960
				(4.35)	(4.13)	(1.52)	(1.27)	(1.43)	(1.27)	(0.41)	(-0.15)
Housing Condition PC1					1.199***				1.095*		
					(4.70)				(1.72)		
Housing Condition PC2					1.044				0.972		
					(1.02)				(-0.51)		
Observations	6460	6447	6444	6441	6441	5068	5062	4960	5062	4594	4590
Pseudo R-squared	0.003	0.005	0.013	0.019	0.020	0.048	0.056	0.053	0.057	0.074	0.087

Coefficients are odds ratios; t statistics in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 17. Logistic Regression Results (Key Variables) of Child Illnesses in the First 9 Months

Cough

3Variable	(1) Illness (Y/N)	(2) Illness (Y/N)	(3) Illness (Y/N)	(4) Illness (Y/N)	(5) Illness (Y/N)	(6) Illness (Y/N)	(7) Illness (Y/N)	(8) Illness (Y/N)	(9) Illness (Y/N)	(10) Illness (Y/N)	(11) Illness (Y/N))	(12) Illness (Y/N)
Damp (Baby Room)	1.294***	1.230***	1.227***	1.228***		1.263***	1.264***	1.254***			1.294***	1.338***
	(4.29)	(3.23)	(3.20)	(3.18)		(3.11)	(3.11)	(2.98)			(3.19)	(3.55)
Mould (Baby Room)		1.256***	1.245***	1.242***		1.189*	1.177*	1.195*			1.157	1.111
		(2.85)	(2.73)	(2.69)		(1.85)	(1.72)	(1.87)			(1.41)	(1.01)
Unheated (House)			1.084	1.080		0.925	0.904	0.925			0.841	0.844
			(0.98)	(0.92)		(-0.74)	(-0.94)	(-0.72)			(-1.41)	(-1.32)
Crowded (>2 ppl per bedroom)				1.016	0.994	1.018	0.980	0.995	0.969	0.974	0.959	0.978
				(0.20)	(-0.07)	(0.17)	(-0.19)	(-0.04)	(-0.31)	(-0.21)	(-0.35)	(-0.18)
Housing Condition PC1					1.111***				1.081***	1.070**		
					(5.65)				(3.24)	(2.47)		
Housing Condition PC2					0.944***				0.920***	0.908***		
					(-2.78)				(-3.30)	(-3.39)		
Observations	6457	6444	6441	6438	6438	5066	5060	4958	5060	4589	4593	4589
Pseudo R-squared	0.002	0.003	0.003	0.003	0.005	0.009	0.013	0.012	0.014	0.029	0.020	0.029

Ear Infection

Variable	(1) Illness (Y/N)	(2) Illness (Y/N)	(3) Illness (Y/N)	(4) Illness (Y/N)	(5) Illness (Y/N)	(6) Illness (Y/N)	(7) Illness (Y/N)	(8) Illness (Y/N)	(9) Illness (Y/N)	(10) Illness (Y/N)	(11) Illness (Y/N)	(12) Illness (Y/N)
Damp (Baby Room)	1.169**	1.102	1.101	1.094		1.126	1.119	1.134			1.137	1.162
	(2.22)	(1.30)	(1.28)	(1.19)		(1.35)	(1.27)	(1.41)			(1.37)	(1.57)
Mould (Baby Room)		1.281***	1.271***	1.260**		1.205*	1.188	1.179			1.162	1.101
		(2.73)	(2.61)	(2.50)		(1.72)	(1.58)	(1.50)			(1.27)	(0.80)
Unheated (House)			1.089	1.069		0.957	0.944	0.918			0.915	0.892
			(0.88)	(0.68)		(-0.35)	(-0.46)	(-0.68)			(-0.61)	(-0.76)
Crowded (>2 ppl per bedroom)				1.095	1.059	0.919	0.901	0.922	0.887	0.942	0.957	0.942
				(0.95)	(0.60)	(-0.68)	(-0.83)	(-0.65)	(-0.96)	(-0.41)	(-0.31)	(-0.41)
Housing Condition PC1					1.085***				1.061**	1.046		
					(3.82)				(2.17)	(1.43)		
Housing Condition PC2					1.012				0.981	0.977		
					(0.49)				(-0.65)	(-0.72)		
Observations	6460	6447	6444	6441	6441	5068	5062	4960	5062	4590	4594	4590
Pseudo R-squared	0.001	0.002	0.002	0.002	0.003	0.010	0.017	0.015	0.017	0.037	0.025	0.037

Gastroenteritis

Variable	(1) Illness (Y/N)	(2) Illness (Y/N)	(3) Illness (Y/N)	(4) Illness (Y/N)	(5) Illness (Y/N)	(6) Illness (Y/N)	(7) Illness (Y/N)	(8) Illness (Y/N)	(9) Illness (Y/N)	(10) Illness (Y/N)	(11) Illness (Y/N)	(12) Illness (Y/N)
Damp (Baby Room)	1.314***	1.129	1.125	1.099		0.898	0.893	0.895			0.907	0.924
	(3.89)	(1.61)	(1.56)	(1.24)		(-1.16)	(-1.21)	(-1.18)			(-0.98)	(-0.79)
Mould (Baby Room)		1.658***	1.641***	1.603***		1.711***	1.699***	1.694***			1.589***	1.545***
		(5.71)	(5.54)	(5.26)		(5.10)	(4.99)	(4.93)			(3.96)	(3.71)
Unheated (House)			1.105	1.049		0.858	0.829	0.814			0.697**	0.712**

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
			(1.03)	(0.48)		(-1.21)	(-1.46)	(-1.59)			(-2.32)	(-2.13)
Crowded (>2 ppl per bedroom)				1.282***	1.266**	1.219*	1.172	1.197	1.163	1.168	1.138	1.170
				(2.65)	(2.50)	(1.66)	(1.32)	(1.49)	(1.26)	(1.10)	(0.95)	(1.11)
Housing Condition PC1					1.115***				1.041	1.017		
					(5.06)				(1.44)	(0.49)		
Housing Condition PC2					0.946**				0.927**	0.910***		
					(-2.28)				(-2.52)	(-2.81)		
Observations	6458	6445	6442	6439	6439	5067	5061	4959	5061	4591	4595	4591
Pseudo R-squared	0.002	0.007	0.007	0.008	0.007	0.017	0.024	0.023	0.021	0.030	0.027	0.032

Skin Infection

Variable	(1) Illness (Y/N)	(2) Illness (Y/N)	(3) Illness (Y/N)	(4) Illness (Y/N)	(5) Illness (Y/N)	(6) Illness (Y/N)	(7) Illness (Y/N)	(8) Illness (Y/N)	(9) Illness (Y/N)	(10) Illness (Y/N)	(11) Illness (Y/N)	(12) Illness (Y/N)
Damp (Baby Room)	1.429***	1.228*	1.209*	1.188		1.199	1.204	1.202			1.191	1.231
	(3.52)	(1.86)	(1.70)	(1.52)		(1.33)	(1.36)	(1.33)			(1.16)	(1.37)
Mould (Baby Room)		1.681***	1.588***	1.560***		1.487**	1.473**	1.499**			1.264	1.228
		(4.13)	(3.60)	(3.45)		(2.55)	(2.48)	(2.56)			(1.27)	(1.12)
Unheated (House)			1.669***	1.608***		1.338*	1.345*	1.361*			1.396*	1.380
			(4.10)	(3.77)		(1.75)	(1.76)	(1.83)			(1.70)	(1.55)
Crowded (>2 ppl per bedroom)				1.194	1.211	0.970	0.958	0.912	0.976	0.807	0.782	0.787
				(1.35)	(1.46)	(-0.17)	(-0.25)	(-0.52)	(-0.14)	(-0.95)	(-1.13)	(-1.07)
Housing Condition PC1					1.170***				1.125***	1.076		
					(5.19)				(2.87)	(1.47)		
Housing Condition PC2					1.024				0.984	0.987		
					(0.73)				(-0.41)	(-0.27)		
Observations	6460	6447	6444	6441	6441	5069	5063	4961	5063	4591	4595	4591
Pseudo R-squared	0.003	0.008	0.012	0.012	0.010	0.022	0.023	0.025	0.021	0.030	0.025	0.031

Coefficients are odds ratios; t statistics in parentheses

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 18. Ordered Logistic Regression Results (Key Variables) For Number of Illnesses of Child in the First 9 Months, by Illness

Variable	(1) Illness Incidents (N)	(2) Illness Incidents (N)	(3) Illness Incidents (N)	(4) Illness Incidents (N)	(5) Illness Incidents (N)	(6) Illness Incidents (N)	(7) Illness Incidents (N)	(8) Illness Incidents (N)	(9) Illness Incidents (N)	(10) Illness Incidents (N)	(11) Illness Incidents (N)
Cough											
Damp (Baby Room)	1.313***	1.252***	1.247***	1.247***		1.276***	1.275***	1.269***		1.314***	1.362***
	(4.58)	(3.54)	(3.47)	(3.44)		(3.26)	(3.24)	(3.14)		(3.41)	(3.79)
Mould (Baby Room)		1.232***	1.216**	1.213**		1.182*	1.168*	1.190*		1.150	1.102
		(2.68)	(2.49)	(2.45)		(1.82)	(1.67)	(1.86)		(1.37)	(0.94)
Unheated (House)			1.141	1.136		0.962	0.941	0.965		0.892	0.892
			(1.56)	(1.47)		(-0.35)	(-0.55)	(-0.31)		(-0.88)	(-0.85)
Crowded (>2 ppl per bedroom)				1.022	0.997	1.008	0.969	0.982	0.955	0.928	0.933
				(0.26)	(-0.04)	(0.07)	(-0.30)	(-0.17)	(-0.44)	(-0.64)	(-0.57)
Housing Condition PC1					1.120***				1.090***		
					(6.18)				(3.63)		
Housing Condition PC2					0.951**				0.923***		
					(-2.37)				(-3.09)		
Observations	6457	6444	6441	6438	6438	5066	5060	4958	5060	4593	4589
Pseudo R-squared	0.002	0.003	0.003	0.003	0.004	0.008	0.012	0.011	0.013	0.018	0.026
Ear Infection											
Damp (Baby Room)	1.167**	1.098	1.097	1.090		1.122	1.116	1.131		1.134	1.157
	(2.21)	(1.26)	(1.24)	(1.15)		(1.31)	(1.25)	(1.38)		(1.34)	(1.53)
Mould (Baby Room)		1.288***	1.276***	1.266**		1.207*	1.190	1.183		1.176	1.114
		(2.79)	(2.66)	(2.55)		(1.74)	(1.60)	(1.53)		(1.37)	(0.89)
Unheated (House)			1.098	1.081		0.969	0.953	0.929		0.917	0.897
			(0.97)	(0.78)		(-0.25)	(-0.38)	(-0.58)		(-0.60)	(-0.72)
Crowded (>2 ppl per bedroom)				1.084	1.047	0.909	0.891	0.912	0.876	0.949	0.932
				(0.85)	(0.48)	(-0.77)	(-0.93)	(-0.74)	(-1.06)	(-0.38)	(-0.48)
Housing Condition PC1					1.088***				1.064**		
					(3.95)				(2.26)		
Housing Condition PC2					1.015				0.986		
					(0.62)				(-0.48)		
Observations	6460	6447	6444	6441	6441	5068	5062	4960	5062	4594	4590
Pseudo R-squared	0.001	0.002	0.002	0.002	0.002	0.009	0.015	0.013	0.015	0.022	0.033
Gastroenteritis											
Variable	(1) Illness Incidents (N)	(2) Illness Incidents (N)	(3) Illness Incidents (N)	(4) Illness Incidents (N)	(5) Illness Incidents (N)	(6) Illness Incidents (N)	(7) Illness Incidents (N)	(8) Illness Incidents (N)	(9) Illness Incidents (N)	(10) Illness Incidents (N)	(11) Illness Incidents (N)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Damp (Baby Room)	1.323***	1.131	1.127	1.100		0.899	0.896	0.900		0.908	0.928
	(3.99)	(1.63)	(1.57)	(1.24)		(-1.14)	(-1.18)	(-1.12)		(-0.96)	(-0.74)
Mould (Baby Room)		1.687***	1.666***	1.627***		1.756***	1.744***	1.738***		1.616***	1.572***
		(5.84)	(5.65)	(5.36)		(5.26)	(5.16)	(5.09)		(4.04)	(3.79)
Unheated (House)			1.123	1.064		0.873	0.847	0.831		0.710**	0.729*
			(1.18)	(0.62)		(-1.06)	(-1.28)	(-1.41)		(-2.14)	(-1.93)
Crowded (>2 ppl per bedroom)				1.295***	1.277***	1.243*	1.197	1.224	1.183	1.165	1.202
				(2.74)	(2.58)	(1.80)	(1.47)	(1.64)	(1.38)	(1.10)	(1.27)
Housing Condition PC1					1.120***				1.050*		
					(5.27)				(1.73)		
Housing Condition PC2					0.947**				0.930**		
					(-2.18)				(-2.42)		
Observations	6458	6445	6442	6439	6439	5067	5061	4959	5061	4595	4591
Pseudo R-squared	0.002	0.006	0.006	0.007	0.007	0.016	0.023	0.021	0.020	0.025	0.030

Skin Infection

Variable	(1) Illness Incidents (N)	(2) Illness Incidents (N)	(3) Illness Incidents (N)	(4) Illness Incidents (N)	(5) Illness Incidents (N)	(6) Illness Incidents (N)	(7) Illness Incidents (N)	(8) Illness Incidents (N)	(9) Illness Incidents (N)	(10) Illness Incidents (N)	(11) Illness Incidents (N)
Damp (Baby Room)	1.423***	1.221*	1.201	1.180		1.188	1.193	1.190		1.184	1.224
	(3.48)	(1.81)	(1.64)	(1.47)		(1.27)	(1.30)	(1.26)		(1.13)	(1.34)
Mould (Baby Room)		1.691***	1.598***	1.569***		1.498***	1.484**	1.511***		1.274	1.239
		(4.16)	(3.65)	(3.48)		(2.60)	(2.52)	(2.61)		(1.32)	(1.17)
Unheated (House)			1.666***	1.605***		1.334*	1.340*	1.357*		1.388*	1.370
			(4.09)	(3.75)		(1.73)	(1.74)	(1.82)		(1.68)	(1.52)
Crowded (>2 ppl per bedroom)				1.194	1.211	0.972	0.959	0.914	0.977	0.787	0.792
				(1.35)	(1.46)	(-0.16)	(-0.24)	(-0.51)	(-0.13)	(-1.10)	(-1.04)
Housing Condition PC1					1.170***				1.124***		
					(5.17)				(2.86)		
Housing Condition PC2					1.025				0.984		
					(0.75)				(-0.39)		
Observations	6460	6447	6444	6441	6441	5069	5063	4961	5063	4595	4591
Pseudo R-squared	0.003	0.007	0.011	0.011	0.009	0.020	0.021	0.023	0.020	0.023	0.029

Coefficients are odds ratios; t statistics in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 19. Ordered Logistic Regression Results (Key Variables) For Number of Doctor Visits due to Child Illnesses in the First 9 Months

Cough

Variable	(1) Doctor Visits (N)	(2) Doctor Visits (N)	(3) Doctor Visits (N)	(4) Doctor Visits (N)	(5) Doctor Visits (N)	(6) Doctor Visits (N)	(7) Doctor Visits (N)	(8) Doctor Visits (N)	(9) Doctor Visits (N)	(10) Doctor Visits (N)	(11) Doctor Visits (N)
Damp (Baby Room)	1.354***	1.268***	1.261***	1.260***		1.252***	1.250***	1.248***		1.284***	1.303***
	(5.08)	(3.75)	(3.66)	(3.61)		(3.03)	(3.00)	(2.95)		(3.12)	(3.27)
Mould (Baby Room)		1.327***	1.301***	1.296***		1.257**	1.254**	1.265**		1.220*	1.174
		(3.60)	(3.33)	(3.28)		(2.47)	(2.43)	(2.51)		(1.94)	(1.55)
Unheated (House)			1.221**	1.212**		1.008	0.979	1.003		0.978	0.937
			(2.38)	(2.23)		(0.08)	(-0.19)	(0.03)		(-0.17)	(-0.48)
Crowded (>2 ppl per bedroom)				1.035	1.007	0.946	0.918	0.935	0.903	0.888	0.843
				(0.42)	(0.08)	(-0.54)	(-0.84)	(-0.65)	(-1.00)	(-1.01)	(-1.39)
Housing Condition PC1					1.144***				1.104***		
					(7.21)				(4.12)		
Housing Condition PC2					0.963*				0.935***		
					(-1.80)				(-2.62)		
Observations	6457	6444	6441	6438	6438	5066	5060	4958	5060	4593	4589
Pseudo R-squared	0.002	0.004	0.004	0.004	0.006	0.009	0.014	0.013	0.015	0.018	0.024

Ear Infection

Variable	(1) Doctor Visits (N)	(2) Doctor Visits (N)	(3) Doctor Visits (N)	(4) Doctor Visits (N)	(5) Doctor Visits (N)	(6) Doctor Visits (N)	(7) Doctor Visits (N)	(8) Doctor Visits (N)	(9) Doctor Visits (N)	(10) Doctor Visits (N)	(11) Doctor Visits (N)
Damp (Baby Room)	1.161**	1.094	1.093	1.086		1.110	1.102	1.117		1.113	1.135
	(2.13)	(1.20)	(1.19)	(1.10)		(1.19)	(1.10)	(1.24)		(1.14)	(1.33)
Mould (Baby Room)		1.287***	1.277***	1.266**		1.200*	1.189	1.178		1.170	1.106
		(2.76)	(2.65)	(2.54)		(1.67)	(1.57)	(1.48)		(1.31)	(0.82)
Unheated (House)			1.083	1.065		0.963	0.948	0.921		0.902	0.872
			(0.82)	(0.63)		(-0.30)	(-0.42)	(-0.64)		(-0.72)	(-0.92)
Crowded (>2 ppl per bedroom)				1.088	1.049	0.942	0.925	0.949	0.908	0.995	0.969
				(0.88)	(0.50)	(-0.49)	(-0.63)	(-0.43)	(-0.78)	(-0.04)	(-0.22)
Housing Condition PC1					1.085***				1.062**		
					(3.83)				(2.20)		
Housing Condition PC2					1.013				0.987		
					(0.53)				(-0.46)		
Observations	6460	6447	6444	6441	6441	5068	5062	4960	5062	4594	4590
Pseudo R-squared	0.001	0.002	0.002	0.002	0.002	0.008	0.014	0.012	0.014	0.022	0.032

Gastroenteritis

Variable	(1) Doctor Visits (N)	(2) Doctor Visits (N)	(3) Doctor Visits (N)	(4) Doctor Visits (N)	(5) Doctor Visits (N)	(6) Doctor Visits (N)	(7) Doctor Visits (N)	(8) Doctor Visits (N)	(9) Doctor Visits (N)	(10) Doctor Visits (N)	(11) Doctor Visits (N)
Damp (Baby Room)	1.341***	1.140	1.130	1.088		0.853	0.845	0.843		0.858	0.862
	(3.67)	(1.52)	(1.42)	(0.96)		(-1.46)	(-1.54)	(-1.56)		(-1.30)	(-1.26)
Mould (Baby Room)		1.684***	1.643***	1.587***		1.736***	1.733***	1.723***		1.604***	1.575***
		(5.23)	(4.91)	(4.54)		(4.62)	(4.55)	(4.48)		(3.54)	(3.39)
Unheated (House)			1.260**	1.164		0.987	0.962	0.938		0.806	0.791
			(2.14)	(1.36)		(-0.10)	(-0.28)	(-0.45)		(-1.22)	(-1.31)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Crowded (>2 ppl per bedroom)				1.450***	1.410***	1.265*	1.229	1.252*	1.202	1.242	1.210
				(3.61)	(3.31)	(1.77)	(1.53)	(1.66)	(1.36)	(1.43)	(1.22)
Housing Condition PC1					1.136***				1.068**		
					(5.33)				(2.09)		
Housing Condition PC2					0.976				0.965		
					(-0.87)				(-1.04)		
Observations	6456	6443	6440	6437	6437	5065	5059	4957	5059	4594	4590
Pseudo R-squared	0.002	0.006	0.007	0.009	0.009	0.020	0.027	0.026	0.024	0.029	0.031

Skin Infection

Variable	(1) Doctor Visits (N)	(2) Doctor Visits (N)	(3) Doctor Visits (N)	(4) Doctor Visits (N)	(5) Doctor Visits (N)	(6) Doctor Visits (N)	(7) Doctor Visits (N)	(8) Doctor Visits (N)	(9) Doctor Visits (N)	(10) Doctor Visits (N)	(11) Doctor Visits (N)
Damp (Baby Room)	1.357***	1.136	1.115	1.093		1.122	1.122	1.117		1.101	1.123
	(2.83)	(1.10)	(0.92)	(0.74)		(0.79)	(0.79)	(0.75)		(0.60)	(0.72)
Mould (Baby Room)		1.802***	1.696***	1.664***		1.555***	1.549***	1.563***		1.336	1.309
		(4.52)	(3.97)	(3.82)		(2.73)	(2.68)	(2.71)		(1.51)	(1.41)
Unheated (House)			1.732***	1.663***		1.453**	1.441**	1.473**		1.516**	1.445*
			(4.25)	(3.87)		(2.20)	(2.14)	(2.27)		(2.11)	(1.75)
Crowded (>2 ppl per bedroom)				1.217	1.233	1.007	0.990	0.934	1.008	0.837	0.807
				(1.43)	(1.53)	(0.04)	(-0.06)	(-0.37)	(0.05)	(-0.79)	(-0.92)
Housing Condition PC1					1.170***				1.129***		
					(4.89)				(2.82)		
Housing Condition PC2					1.039				1.002		
					(1.13)				(0.05)		
Observations	6460	6447	6444	6441	6441	5069	5063	4961	5063	4595	4591
Pseudo R-squared	0.002	0.007	0.012	0.012	0.009	0.022	0.024	0.025	0.021	0.028	0.033

Coefficients are odds ratios; t statistics in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 20. Ordered Logistic Regression Results (Key Variables) For Number of Hospital Admissions due to Child Illnesses in the First 9 Months, by Illness

Variable	(1) Hospital Admits (N)	(2) Hospital Admits (N)	(3) Hospital Admits (N)	(4) Hospital Admits (N)	(5) Hospital Admits (N)	(6) Hospital Admits (N)	(7) Hospital Admits (N)	(8) Hospital Admits (N)	(9) Hospital Admits (N)	(10) Hospital Admits (N)	(11) Hospital Admits (N)
Cough											
Damp (Baby Room)	1.626**	1.455*	1.416*	1.339		1.050	1.072	1.065		1.279	1.309
	(2.55)	(1.84)	(1.68)	(1.37)		(0.18)	(0.25)	(0.22)		(0.82)	(0.88)
Mould (Baby Room)		1.492*	1.330	1.264		0.946	0.899	0.933		0.702	0.642
		(1.69)	(1.19)	(0.95)		(-0.17)	(-0.32)	(-0.21)		(-0.88)	(-1.07)
Unheated (House)			2.302***	2.064***		1.063	1.055	1.070		1.253	1.077
			(3.90)	(3.24)		(0.18)	(0.16)	(0.20)		(0.55)	(0.18)
Crowded (>2 ppl per bedroom)				1.627**	1.625**	1.357	1.330	1.349	1.341	1.418	1.226
				(2.03)	(2.02)	(0.95)	(0.88)	(0.91)	(0.91)	(0.96)	(0.53)
Housing Condition PC1					1.226***				0.995		
					(3.48)				(-0.06)		
Housing Condition PC2					1.028				0.960		
					(0.43)				(-0.47)		
Observations	6457	6444	6441	6438	6438	5066	5060	4958	5060	4593	4589
Pseudo R-squared	0.004	0.006	0.015	0.017	0.016	0.038	0.046	0.043	0.046	0.072	0.084
Ear Infection											
Damp (Baby Room)	0.992	1.009	0.968	1.018		0.765	0.765	0.893		0.828	0.825
	(-0.02)	(0.02)	(-0.08)	(0.05)		(-0.63)	(-0.63)	(-0.29)		(-0.36)	(-0.36)
Mould (Baby Room)		0.964	0.790	0.824		0.969	0.941	0.681		0.792	0.719
		(-0.08)	(-0.48)	(-0.39)		(-0.06)	(-0.12)	(-0.78)		(-0.41)	(-0.59)
Unheated (House)			3.668***	4.006***		2.643**	2.500**	2.309*		2.366	1.634
			(3.65)	(3.81)		(2.05)	(1.97)	(1.70)		(1.46)	(0.83)
Crowded (>2 ppl per bedroom)				0.583	0.567	0.461	0.445	0.437	0.443	0.471	0.380
				(-0.95)	(-0.99)	(-1.21)	(-1.30)	(-1.30)	(-1.29)	(-0.85)	(-1.14)
Housing Condition PC1					1.208*				1.060		
					(1.77)				(0.42)		
Housing Condition PC2					1.371**				1.220		
					(2.43)				(1.35)		
Observations	6460	6447	6444	6441	6441	5068	5062	4960	5062	4594	4590
Pseudo R-squared	0.000	0.000	0.021	0.023	0.024	0.098	0.129	0.117	0.125	0.143	0.162
Gastroenteritis											
Damp (Baby Room)	1.579**	1.213	1.193	1.145		0.851	0.837	0.785		0.982	0.998
	(2.10)	(0.82)	(0.73)	(0.56)		(-0.52)	(-0.57)	(-0.75)		(-0.05)	(-0.01)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Mould (Baby Room)		2.277***	2.197***	2.121***		1.926**	1.958**	2.025**		1.430	1.337
		(3.30)	(3.13)	(2.94)		(2.24)	(2.24)	(2.36)		(0.95)	(0.76)
Unheated (House)			1.389	1.281		1.027	1.033	0.807		0.763	0.660
			(1.16)	(0.84)		(0.08)	(0.09)	(-0.58)		(-0.53)	(-0.78)
Crowded (>2 ppl per bedroom)				1.434	1.393	0.768	0.741	0.781	0.752	0.680	0.636
				(1.31)	(1.18)	(-0.69)	(-0.77)	(-0.63)	(-0.72)	(-0.80)	(-0.93)
Housing Condition PC1					1.217***				1.039		
					(3.15)				(0.50)		
Housing Condition PC2					0.988				0.970		
					(-0.16)				(-0.31)		
Observations	6458	6445	6442	6439	6439	5067	5061	4959	5061	4595	4591
Pseudo R-squared	0.004	0.012	0.014	0.015	0.012	0.053	0.066	0.067	0.061	0.067	0.088

Skin Infection

Variable	(1) Hospital Admits (N)	(2) Hospital Admits (N)	(3) Hospital Admits (N)	(4) Hospital Admits (N)	(5) Hospital Admits (N)	(6) Hospital Admits (N)	(7) Hospital Admits (N)	(8) Hospital Admits (N)	(9) Hospital Admits (N)	(10) Hospital Admits (N)	(11) Hospital Admits (N)
Damp (Baby Room)	0.672	0.464	0.441*	0.406*		0.402	0.347	0.393		0.255	0.278*
	(-0.73)	(-1.62)	(-1.75)	(-1.87)		(-1.50)	(-1.60)	(-1.51)		(-1.57)	(-1.67)
Mould (Baby Room)		2.944***	2.768**	2.661**		3.011**	2.960**	3.018**		4.459**	4.125**
		(2.64)	(2.44)	(2.38)		(2.32)	(2.21)	(2.21)		(2.55)	(2.12)
Unheated (House)			2.008	1.794		0.706	0.625	0.741		1.006	0.662
			(1.39)	(1.20)		(-0.44)	(-0.59)	(-0.35)		(0.01)	(-0.45)
Crowded (>2 ppl per bedroom)				1.711	1.678	1.424	1.216	1.367	1.177	2.514	1.241
				(1.11)	(1.04)	(0.55)	(0.29)	(0.47)	(0.24)	(1.55)	(0.30)
Housing Condition PC1					1.082				0.907		
					(0.52)				(-0.40)		
Housing Condition PC2					1.155				0.952		
					(1.03)				(-0.32)		
Observations	6460	6447	6444	6441	6441	5069	5063	4961	5063	4595	4591
Pseudo R-squared	0.002	0.014	0.019	0.021	0.009	0.134	0.171	0.157	0.155	0.244	0.295

Coefficients are odds ratios; t statistics in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Table 21. Poisson Regression of Respiratory Hospital Admissions and Days in Hospital in first 12 months

Variable	(1) Resp Hosp (Admits)	(2) Resp Hosp (Admits)	(3) Resp Hosp (Admits)	(4) Resp Hosp (Admits)	(5) Resp Hosp (Days)	(6) Resp Hosp (Days)	(7) Resp Hosp (Days)	(8) Resp Hosp (Days)
Damp (House)	1.333**	1.350**	1.584***	1.478***	1.316***	1.325***	1.334***	1.279**
	(2.28)	(2.39)	(3.31)	(2.80)	(2.92)	(2.99)	(2.70)	(2.30)
Mould (Baby Room)	0.955	0.917	0.839	0.800	1.129	1.109	1.046	0.987
	(-0.30)	(-0.57)	(-0.98)	(-1.24)	(1.10)	(0.94)	(0.35)	(-0.10)
Unheated (House)	1.178	1.184	0.836	0.713	0.992	0.999	0.691**	0.584***
	(1.04)	(1.07)	(-0.85)	(-1.58)	(-0.07)	(-0.00)	(-2.18)	(-3.13)
Crowded (>2 ppl per bedroom)	1.330*	1.271	1.171	0.987	1.161	1.136	0.915	0.764*
	(1.93)	(1.61)	(0.87)	(-0.07)	(1.32)	(1.11)	(-0.61)	(-1.82)
Household Income -- omitted >$150K								
<=30	3.845***	3.570***	2.916***	2.912***	3.165***	3.227***	2.428***	2.223***
	(4.18)	(3.77)	(3.06)	(3.02)	(5.23)	(4.94)	(3.59)	(3.19)
>30K <=50K	3.203***	3.221***	2.259**	2.292**	2.538***	2.777***	1.947***	1.845**
	(3.69)	(3.56)	(2.40)	(2.42)	(4.34)	(4.43)	(2.79)	(2.54)
>50 <=70K	2.414***	2.487***	2.247**	2.220**	1.823***	2.026***	1.823**	1.711**
	(2.80)	(2.78)	(2.44)	(2.38)	(2.79)	(3.06)	(2.56)	(2.27)
>70K <=100K	2.009**	2.136**	1.888*	1.920*	1.740***	2.005***	1.782**	1.766**
	(2.21)	(2.31)	(1.91)	(1.96)	(2.59)	(3.04)	(2.50)	(2.45)
>100K <=150K	1.664	1.797*	1.493	1.466	1.450	1.676**	1.523*	1.472
	(1.52)	(1.69)	(1.13)	(1.08)	(1.63)	(2.14)	(1.72)	(1.58)
Housing Tenure -- omitted 'Own'								
Private Rental	1.216	1.176	1.292*	1.218	1.254**	1.211**	1.216*	1.122
	(1.52)	(1.25)	(1.79)	(1.34)	(2.35)	(1.97)	(1.83)	(1.06)
Public Rental	1.890***	1.736***	2.121***	1.564*	2.094***	1.898***	2.136***	1.597***
	(3.37)	(2.88)	(3.31)	(1.93)	(5.22)	(4.43)	(4.46)	(2.71)
Other Rental	1.337	1.248	1.294	1.269	1.650***	1.545**	1.745***	1.681***
	(1.12)	(0.85)	(0.91)	(0.84)	(2.83)	(2.44)	(3.02)	(2.81)
Gestational Age								
Term (37-41 GW)	0.507***	0.514***	0.558***	0.606**	0.479***	0.494***	0.518***	0.537***
	(-3.54)	(-3.46)	(-2.74)	(-2.31)	(-5.02)	(-4.80)	(-4.14)	(-3.86)
PostTerm (>41 GW)	0.197***	0.197***	0.0898**	0.0987**	0.194***	0.200***	0.0906***	0.0965***
	(-2.66)	(-2.65)	(-2.35)	(-2.25)	(-3.76)	(-3.68)	(-3.30)	(-3.21)
Birthweight (Child)	1.000**	1.000***	1.000***	1.000***	1.000	1.000	1.000***	1.000***
	(-2.55)	(-2.63)	(-3.31)	(-3.99)	(-0.65)	(-0.63)	(-2.93)	(-3.56)
Male (Child)	1.430***	1.444***	1.707***	1.682***	1.082	1.092	1.334***	1.313***
	(3.31)	(3.38)	(4.35)	(4.24)	(1.00)	(1.11)	(3.23)	(3.06)
Age (Child at 9m Survey)	1.033**	1.032**	1.046**	1.044**	1.039***	1.037***	1.032**	1.032**
	(2.14)	(2.07)	(2.57)	(2.32)	(3.46)	(3.25)	(2.35)	(2.27)
Winter Interview=1	0.987	0.996	0.864	0.865	0.978	0.988	0.878	0.870
	(-0.11)	(-0.03)	(-1.09)	(-1.08)	(-0.26)	(-0.14)	(-1.32)	(-1.41)
Number GUiNZ Children Born	0.733	0.708	0.915	0.880	0.984	0.987	0.969	0.961
	(-1.04)	(-1.16)	(-0.29)	(-0.42)	(-0.08)	(-0.06)	(-0.14)	(-0.17)
VX Birth		1.028	1.077	1.055		0.861*	0.976	0.931
		(0.25)	(0.61)	(0.43)		(-1.84)	(-0.27)	(-0.78)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VX 6w		1.858	2.046	2.183		1.437	1.368	1.525
		(0.85)	(0.93)	(1.00)		(0.70)	(0.57)	(0.76)
Vx 3m		1.371	0.955	1.056		1.659	1.062	1.179
		(0.80)	(-0.11)	(0.13)		(1.45)	(0.16)	(0.44)
VX 5m		0.585***	0.622**	0.627**		0.831	1.019	1.008
		(-2.87)	(-2.18)	(-2.15)		(-1.19)	(0.10)	(0.04)
No VX @ 9m		2.527	2.522	3.108		2.307	2.200	2.978*
		(1.18)	(1.19)	(1.46)		(1.44)	(1.39)	(1.91)
Mother Smokes		1.369*	1.332	1.164		1.456***	1.545***	1.391**
		(1.94)	(1.51)	(0.79)		(3.12)	(3.08)	(2.32)
Other Smokers in HH		1.178	1.168	1.060		1.168	1.064	0.968
		(1.16)	(0.96)	(0.36)		(1.46)	(0.50)	(-0.26)
Asthma ever (Mother)			1.318**	1.275*			1.360***	1.364***
			(2.15)	(1.86)			(3.26)	(3.24)
BMI (Mother Pre-pregnancy)			1.025***	1.008			1.034***	1.022***
			(2.96)	(0.93)			(5.69)	(3.51)
General Health, Mother Pre-pregnancy -- omitted 'Poor Health'								
Fair			0.822	0.805			0.501***	0.518***
			(-0.45)	(-0.50)			(-2.88)	(-2.72)
Good			1.273	1.336			0.568***	0.630**
			(0.61)	(0.73)			(-2.70)	(-2.19)
Very good			0.992	1.017			0.379***	0.429***
			(-0.02)	(0.04)			(-4.41)	(-3.80)
Excellent			1.018	1.051			0.474***	0.549**
			(0.04)	(0.12)			(-3.21)	(-2.54)
Age (Mother Antenatal)				0.989				0.983**
				(-1.02)				(-2.01)
Preferred Ethnicity (Mother) -- omitted NZ/European								
Maori				1.739***				1.980***
				(3.29)				(5.54)
Pacific				2.688***				2.678***
				(5.40)				(7.08)
Asian				0.469***				0.852
				(-2.82)				(-0.93)
Other				0.197				0.123**
				(-1.61)				(-2.09)
Observations	4568	4563	4148	4144	4568	4563	4148	4144

Coefficients are odds ratios; t statistics in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Table 22. Logistic Regression of Mother's Cough on Most Days, 9-month Survey

Variable	(1) Mother (Cough Y/N)	(2) Mother (Cough Y/N)	(3) Mother (Cough Y/N)	(4) Mother (Cough Y/N)	(5) Mother (Cough Y/N)	(6) Mother (Cough Y/N)	(7) Mother (Cough Y/N)	(8) Mother (Cough Y/N)	(9) Mother (Cough Y/N)	(10) Mother (Cough Y/N)
Damp (House)	1.791***	1.558***	1.524***	1.467***		1.363**	1.366**			1.216
	(6.08)	(4.37)	(4.10)	(3.67)		(2.44)	(2.46)			(1.41)
Mould (Baby Room)		1.635***	1.558***	1.496***		1.250	1.231			1.217
		(4.22)	(3.70)	(3.35)		(1.50)	(1.40)			(1.21)
Unheated (House)			1.553***	1.428***		1.098	1.090			0.982
			(3.49)	(2.68)		(0.55)	(0.50)			(-0.09)
Crowded (>2 ppl per bedroom)				1.476***	1.459***	1.161	1.141	1.150	1.002	0.993
				(3.08)	(2.97)	(0.94)	(0.83)	(0.88)	(0.01)	(-0.03)
Housing Condition PC1					1.208***			1.090**	1.046	
					(6.61)			(2.20)	(0.98)	
Housing Condition PC2					0.988			0.956	0.951	
					(-0.37)			(-1.08)	(-1.06)	
Household Income -- omitted >$150K										
<=30						3.092***	2.511***	2.517***	2.129***	2.125***
						(4.05)	(3.27)	(3.27)	(2.59)	(2.58)
>30K <=50K						1.754**	1.597*	1.607*	1.467	1.460
						(2.05)	(1.69)	(1.71)	(1.35)	(1.33)
>50 <=70K						1.825**	1.687*	1.702**	1.612*	1.602*
						(2.27)	(1.96)	(1.99)	(1.77)	(1.75)
>70K <=100K						1.849**	1.802**	1.802**	1.707**	1.709**
						(2.36)	(2.26)	(2.26)	(2.03)	(2.04)
>100K <=150K						1.560	1.528	1.528	1.424	1.426
						(1.62)	(1.54)	(1.54)	(1.27)	(1.28)
Housing Tenure -- omitted 'Own'										
Private Rental						1.231*	1.146	1.164	1.084	1.073
						(1.66)	(1.07)	(1.20)	(0.59)	(0.52)
Public Rental						1.875***	1.584**	1.631**	1.382	1.355
						(3.13)	(2.26)	(2.41)	(1.30)	(1.22)
Other Rental						1.485	1.374	1.384	1.361	1.361

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
						(1.63)	(1.29)	(1.32)	(1.22)	(1.21)
Mother Smokes							2.320***	2.307***	2.606***	2.616***
							(5.02)	(5.01)	(5.11)	(5.12)
Other Smokers in HH							0.965	0.975	0.865	0.860
							(-0.23)	(-0.17)	(-0.86)	(-0.90)
Asthma ever (Mother)									1.060	1.062
									(0.45)	(0.46)
BMI (Mother Pre-pregnancy)									1.034***	1.034***
									(3.88)	(3.84)
Age (Mother at 9m Survey)									0.995	0.995
									(-0.47)	(-0.44)
Preferred Ethnicity (Mother) -- omitted NZ/European										
Maori									1.309*	1.293
									(1.69)	(1.62)
Pacific									1.470*	1.443*
									(1.86)	(1.78)
Asian									1.151	1.155
									(0.77)	(0.79)
Other									1.043	1.036
									(0.10)	(0.09)
Observations	6460	6448	6445	6442	6442	5081	5080	5080	4600	4600
Pseudo R-squared	0.009	0.013	0.016	0.019	0.018	0.029	0.042	0.040	0.050	0.050

Coefficients are odds ratios; t statistics in parentheses.
* p<0.10, ** p<0.05, *** p<0.01

Table 23. Logistic Regression of Mother General Health Not Good, 9-month Survey

Variable	(1) Mother (Health Not Good)	(2) Mother (Health Not Good)	(3) Mother (Health Not Good)	(4) Mother (Health Not Good)	(5) Mother (Health Not Good)	(6) Mother (Health Not Good)	(7) Mother (Health Not Good)	(8) Mother (Health Not Good)	(9) Mother (Health Not Good)	(10) Mother (Health Not Good)
Damp (House)	1.709***	1.426***	1.414***	1.392***		1.261*	1.248*			1.267*
	(5.72)	(3.58)	(3.46)	(3.28)		(1.94)	(1.85)			(1.85)
Mould (Baby Room)		1.820***	1.789***	1.784***		1.523***	1.509***			1.405**
		(5.36)	(5.20)	(5.12)		(3.11)	(3.04)			(2.26)
Unheated (House)			1.179	1.162		1.025	1.005			1.070
			(1.29)	(1.14)		(0.15)	(0.03)			(0.36)
Crowded (>2 ppl per bedroom)				1.086	1.057	1.163	1.130	1.120	1.224	1.223
				(0.63)	(0.42)	(0.94)	(0.76)	(0.70)	(1.14)	(1.14)
Housing Condition PC1					1.208***			1.121***	1.115**	
					(6.69)			(3.07)	(2.55)	
Housing Condition PC2					0.960			0.953	0.959	
					(-1.26)			(-1.23)	(-0.96)	
Household Income -- omitted >$150K										
<=30						1.935**	1.714**	1.685**	1.213	1.230
						(2.54)	(2.03)	(1.97)	(0.68)	(0.72)
>30K <=50K						2.002***	1.857**	1.835**	1.589*	1.601*
						(2.87)	(2.53)	(2.48)	(1.81)	(1.84)
>50 <=70K						1.651**	1.561*	1.546*	1.390	1.396
						(2.10)	(1.86)	(1.82)	(1.33)	(1.35)
>70K <=100K						1.711**	1.675**	1.655**	1.541*	1.556*
						(2.29)	(2.20)	(2.15)	(1.80)	(1.84)
>100K <=150K						1.532*	1.512*	1.502*	1.437	1.445
						(1.73)	(1.68)	(1.65)	(1.45)	(1.48)
Housing Tenure -- omitted 'Own'										

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Private Rental						1.273**	1.231*	1.230*	1.086	1.084
						(2.12)	(1.82)	(1.82)	(0.67)	(0.66)
Public Rental						1.153	1.043	1.036	1.013	1.010
						(0.64)	(0.18)	(0.15)	(0.05)	(0.04)
Other Rental						1.138	1.113	1.096	1.161	1.173
						(0.52)	(0.43)	(0.37)	(0.61)	(0.64)
Mother Smokes							1.216	1.218	1.267	1.273
							(1.17)	(1.18)	(1.26)	(1.29)
Other Smokers in HH							1.290*	1.288*	1.212	1.213
							(1.87)	(1.86)	(1.34)	(1.34)
Asthma ever (Mother)									1.240*	1.240*
									(1.78)	(1.78)
BMI (Mother Pre-pregnancy)									1.032***	1.032***
									(3.60)	(3.63)
Age (Mother at 9m Survey)									0.996	0.997
									(-0.37)	(-0.33)
Preferred Ethnicity (Mother) -- omitted NZ/European										
Maori									1.607***	1.599***
									(3.02)	(3.00)
Pacific									1.082	1.091
									(0.38)	(0.42)
Asian									1.517***	1.539***
									(2.58)	(2.67)
Other									1.060	1.068
									(0.16)	(0.17)
Observations	6462	6450	6447	6444	6444	5082	5081	5081	4601	4601
Pseudo R-squared	0.008	0.014	0.014	0.014	0.013	0.017	0.021	0.020	0.033	0.033

Coefficients are odds ratios; t statistics in parentheses.
* p<0.10, ** p<0.05, *** p<0.01

Figures

Figure 1: Clustering of Damp, Mould and Lack of Heating in Children's Homes Compared (Actual Clustering) to Conditions Randomly Assigned (Baseline Clustering)
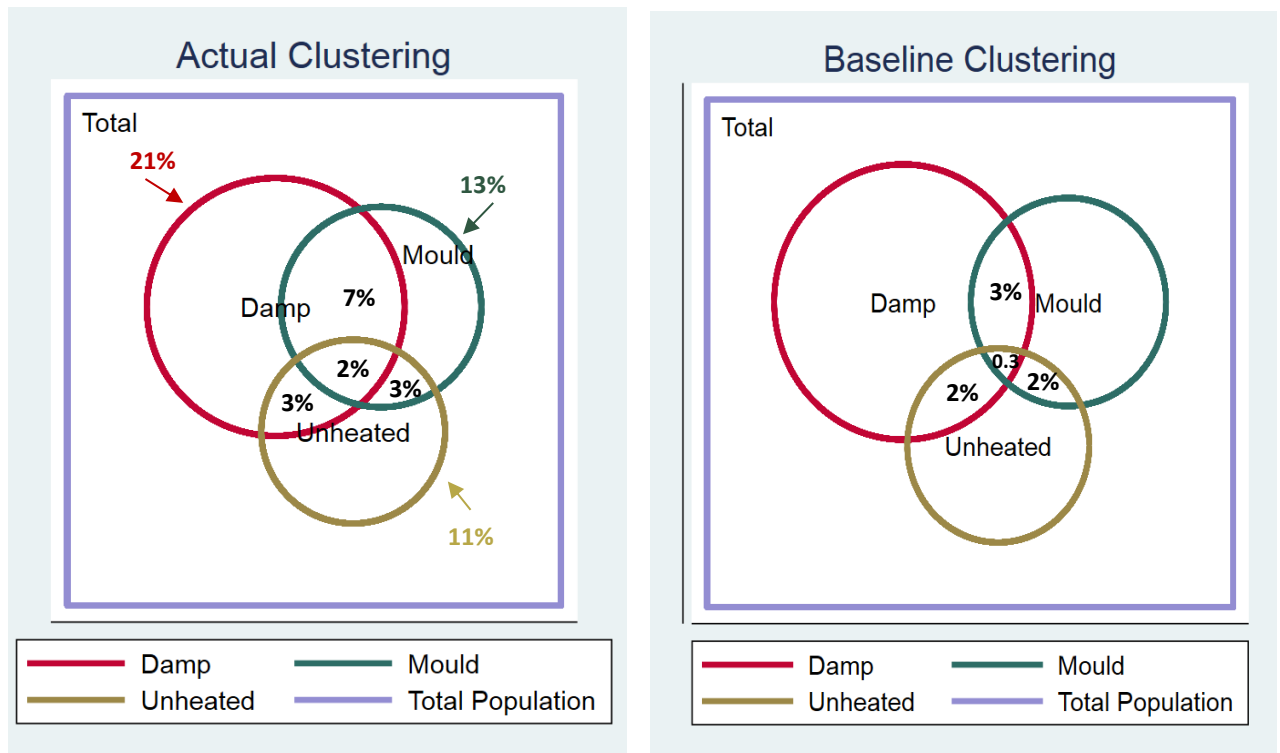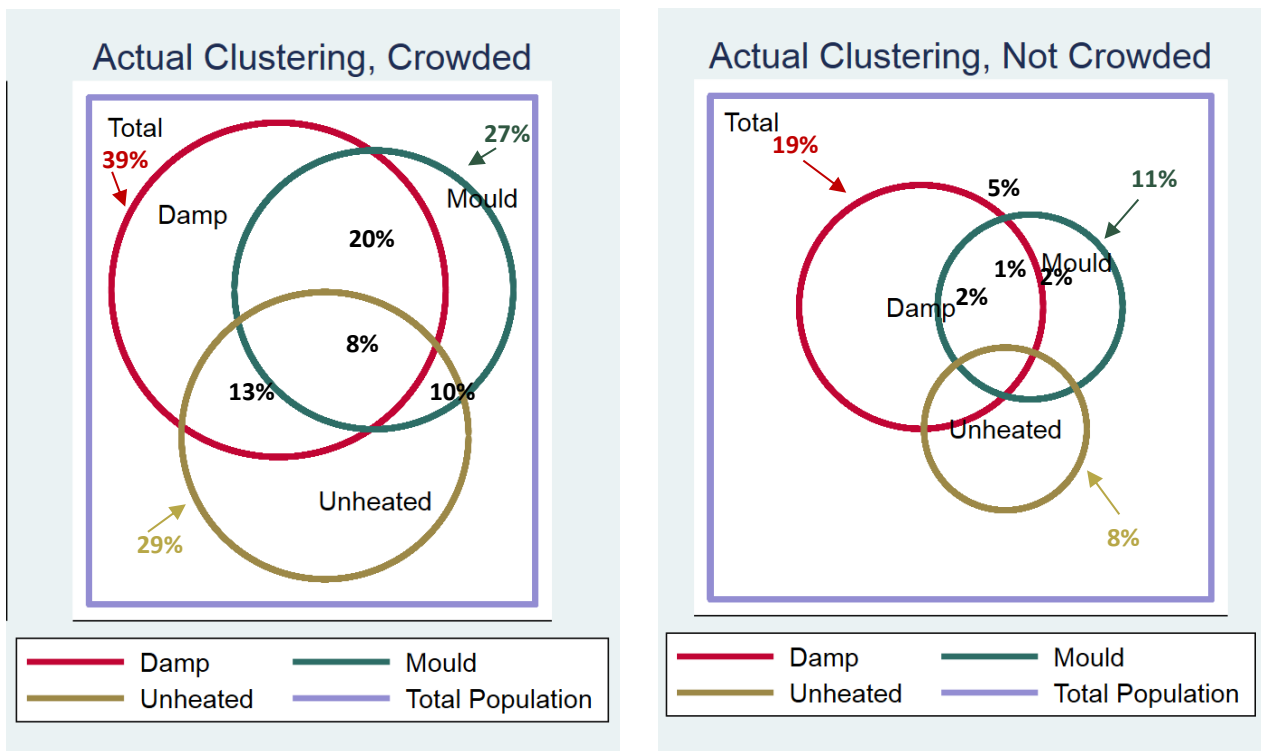
Figure 2: Clustering of Damp, Mould and Lack of Heating in Children's Homes, By Household Crowding Status

Crowding is defined as more than two people per bedroom in the household.

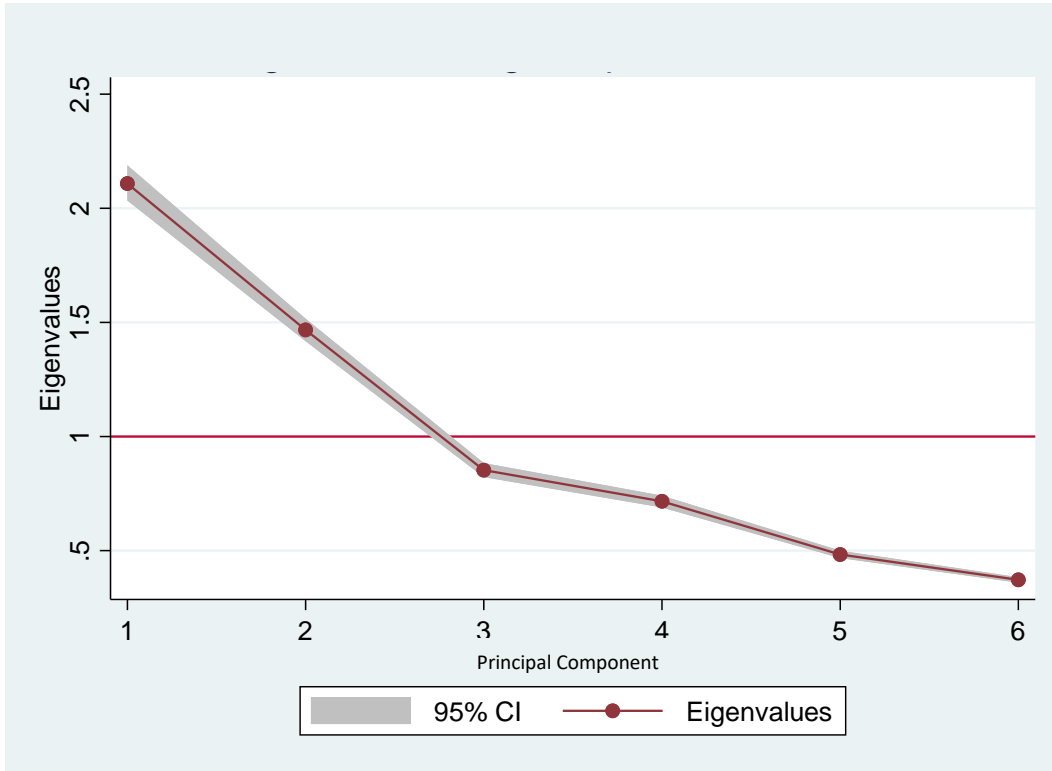**Figure 3: Eigen Values of Principal Components Analysis of Housing Conditions, Including Crowding**

Figure 4: Eigen Values of Principal Components Analysis of Housing Conditions, Excluding Crowding
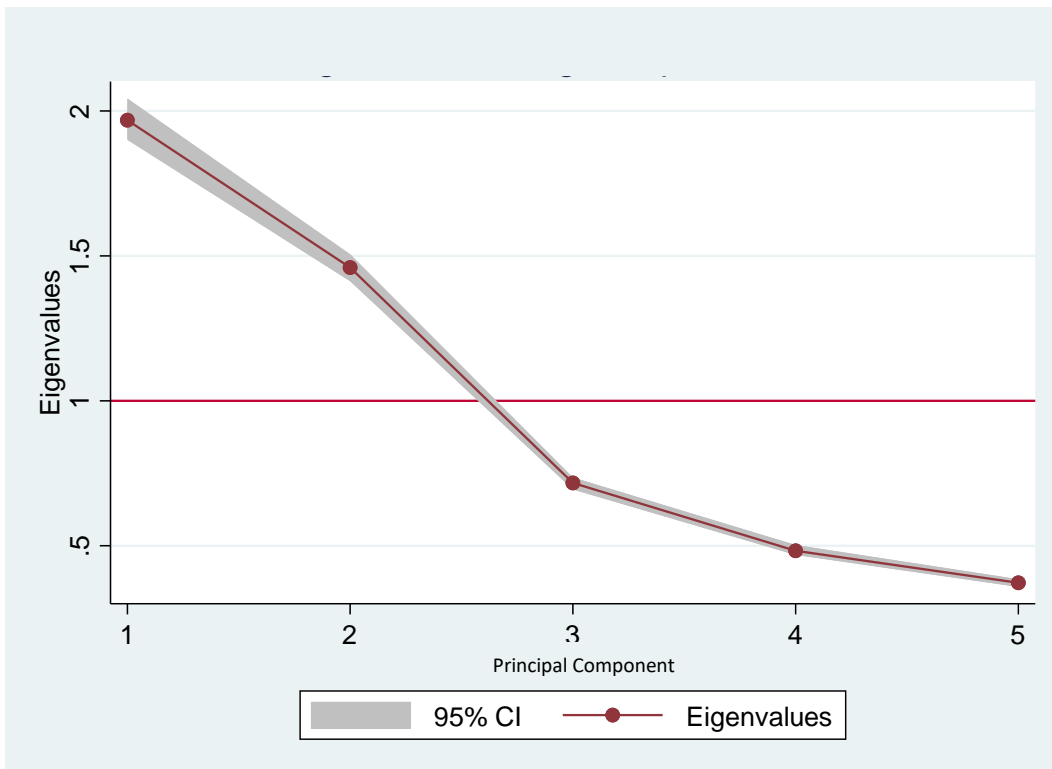
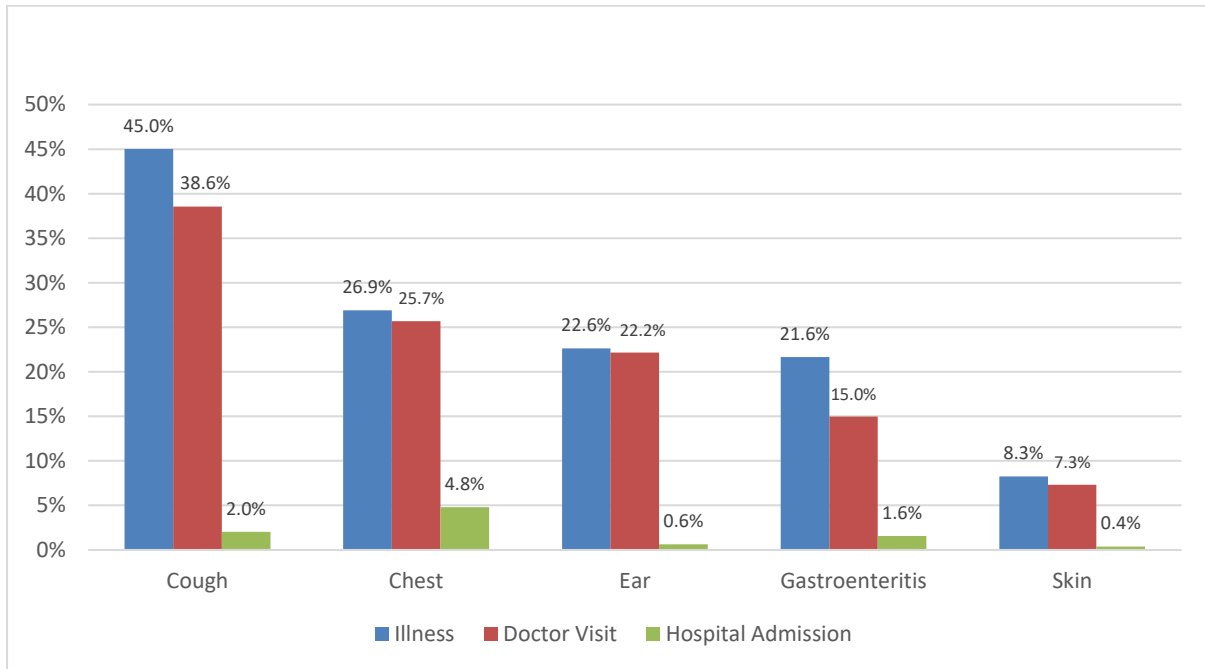**Figure 5: Children's Illnesses and Medical Utilisation in First 9 months, Percentage of Full Sample**

Figure 6: Children's Illnesses and Medical Utilisation in First 9 months, Conditional on Having Illness
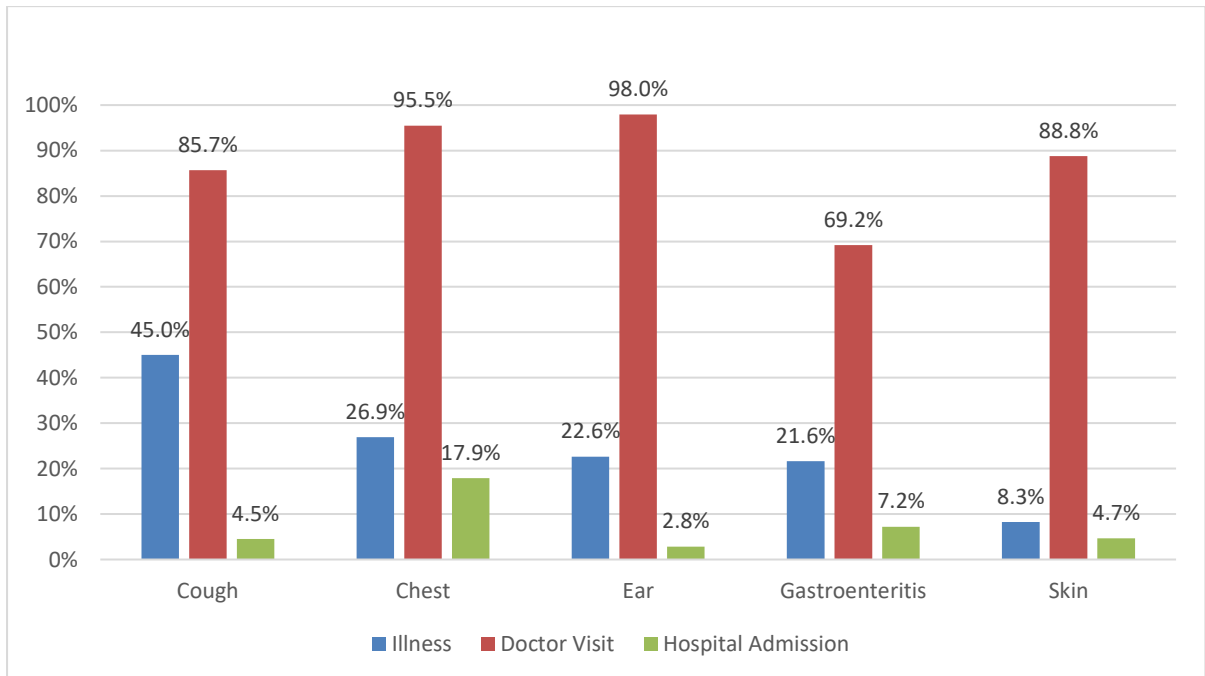
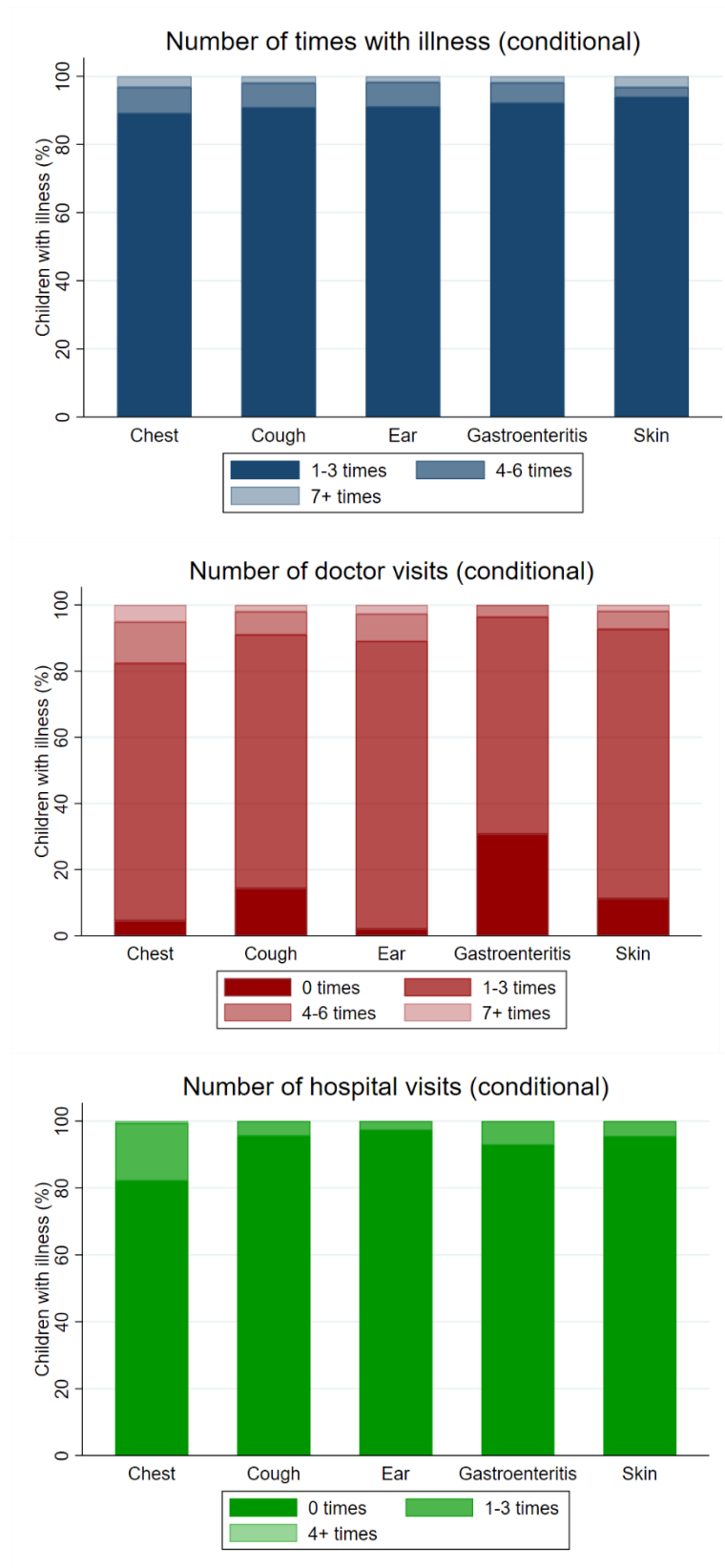**Figure 7: Children's Illnesses and Medical Utilisation, Number of Incidents in First 9 Months**

Figure 8: Reports of Discrimination due to Ethnicity by Mothers and their Partners, Antenatal Survey

Reports of Discrimination due to Ethnicity
Full Sample

Category	Partner	Mother
Job	7.70%	6.50%
Health	5.00%	5.40%
Housing	3.90%	4.80%
Credit	2.60%	1.90%

Reports of Discrimination due to Ethnicity
Conditional on Reporting Discrimination

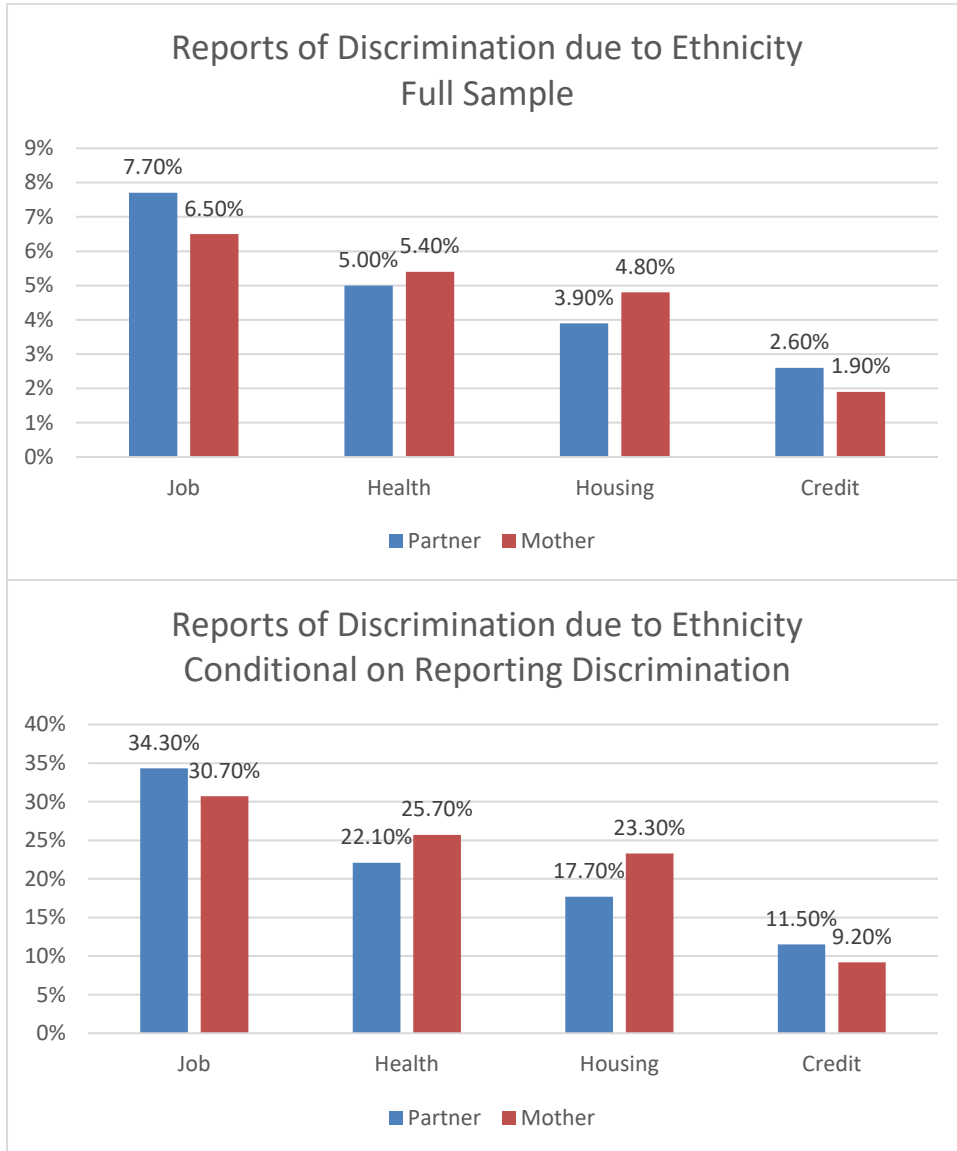| Category	Partner	Mother
Job	34.30%	30.70%
Health	22.10%	25.70%
Housing	17.70%	23.30%
Credit	11.50%	9.20%

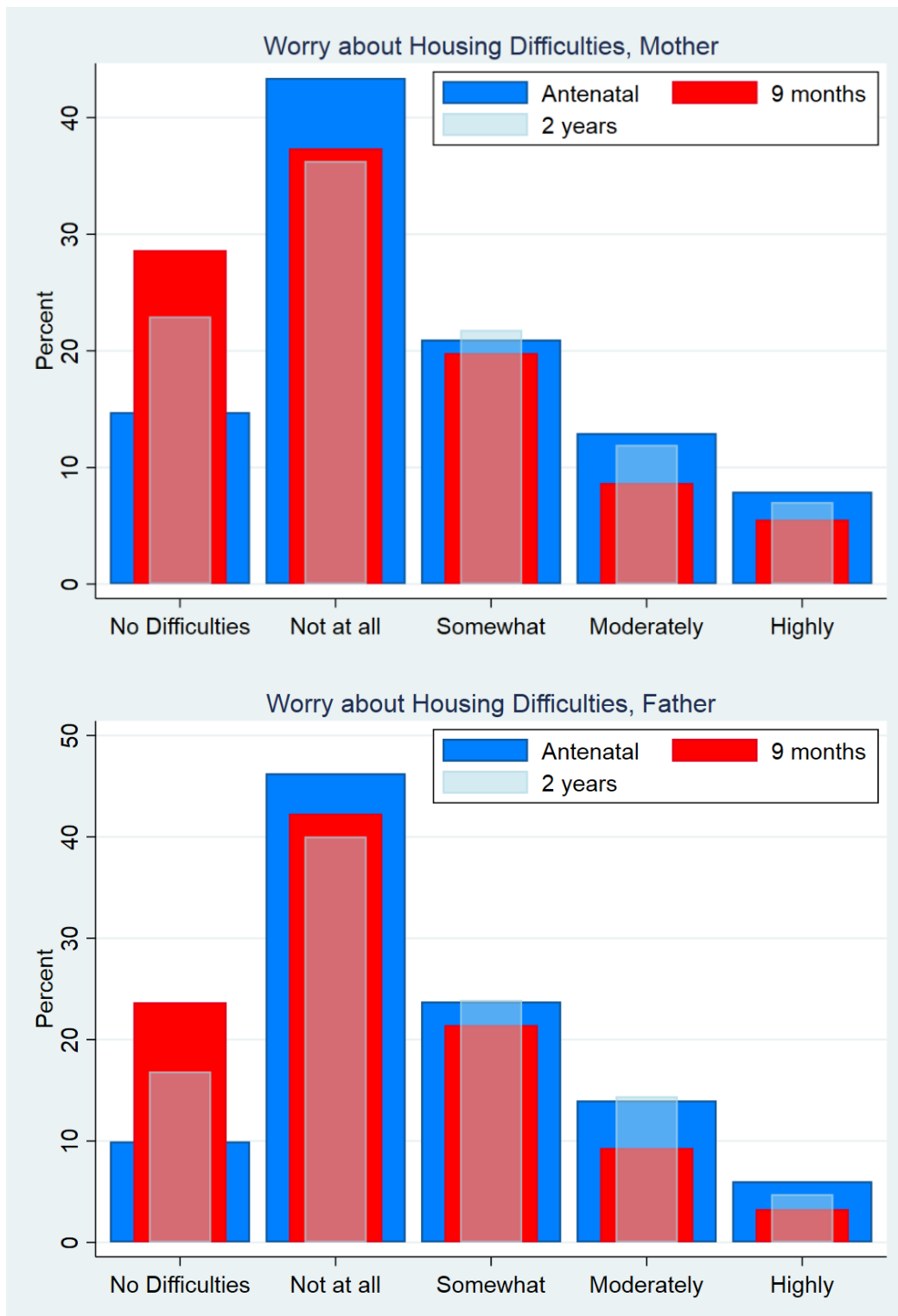**Figure 9. Extent to which Worry about Housing Difficulties is a Source of Stress for the Parents**

Figure 10. Percentage of Mothers and their Partners Reporting Feelings of Unfair Treatment due to Ethnicity (Total Population), Antenatal Survey
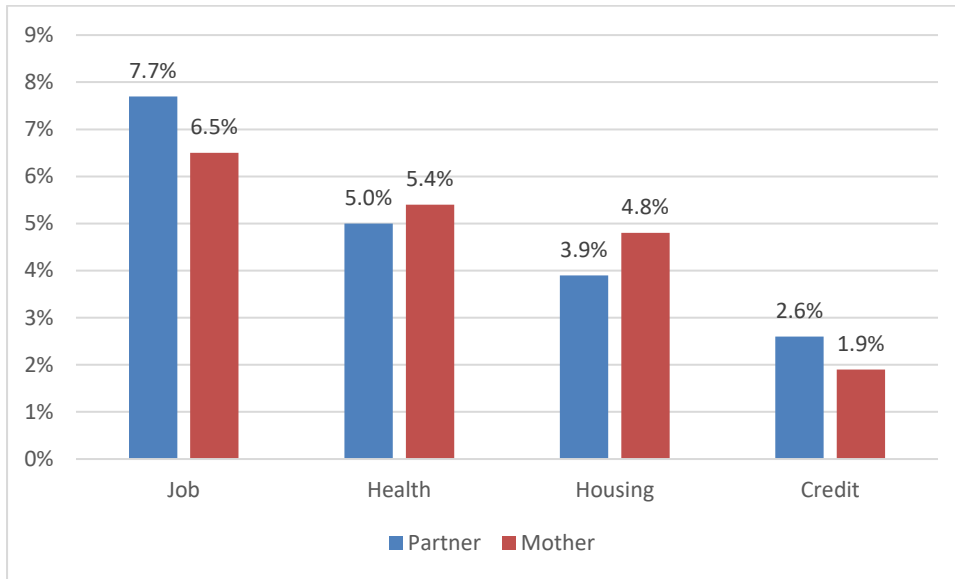

Figure 11. Percentage of Mothers and their Partners Reporting Feelings of Unfair Treatment due to Ethnicity (Conditional on Reporting Discrimination), Antenatal Survey