



**Health Impacts of Social Housing:  
Hospitalisations in Housing New Zealand  
Applicants and Tenants, 2003-2008**

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# 1. Executive Summary

## Introduction

The Social Housing Outcomes Worth (SHOW) Study aims to investigate the relationship between housing conditions and hospitalisation rates in a large cohort of Housing New Zealand Corporation (HNZC) tenants and applicants. This specific report aims to assess the health impacts of moving people from the HNZC waiting list to HNZC tenancies.

## Methods

This study was based on data collected by HNZC as part of its routine business operations. Information on housing applicants was recorded on a Needs Assessment (NA) record form. Most housing tenants self-completed an annual Income Related Rent (IRR) application form. The HNZC data were forwarded to the New Zealand Ministry of Health (MoH) for matching to their national health index number (NHI). The data were then anonymised (including encrypting the NHI) and passed to researchers at the University of Otago, Wellington for analysis. Researchers linked cases to their hospitalisation records using the encrypted NHI. The analysis was based entirely on principal diagnoses (coded using International Statistical Classification of Diseases and Related Health Problems Version 10, ICD.10) for conditions of interest. The *standard filter* excluded private hospital cases, overseas visitors, hospital transfers, hospital waiting list cases, day cases, and readmissions within a month. Age-standardised rates were calculated to take account of the different age structures of *housing applicant* and *housing tenant* populations compared with the New Zealand population not in this cohort (*other NZ*). Analyses were repeated using age-ethnicity standardised rates to further adjust for the relatively high proportion of Māori and Pacific People in the cohort population. Rate ratios (RR) and 95% confidence intervals (95%CI) were calculated using standard methods for age-standardised and age-ethnicity standardised data.

The analysis used the following categories of hospitalisations, which included sets of health conditions that are plausibly related to housing conditions:

- Total acute and arranged hospital admissions
- Total potentially avoidable hospitalisations (PAH), which include Ambulatory Sensitive Hospitalisation (ASH) and Population Preventable Hospitalisation (PPH)
- Housing-related potentially avoidable hospitalisations (HR-PAH)
- Close contact infectious diseases (CCID)
- Circulatory and respiratory disease hospitalisations
- Mental and behavioural disorder hospitalisations
- Home injury hospitalisations.

In addition, it used two other categories of health event that are considered less likely to be related to housing conditions, at least in the short term:

- Non-home injury hospitalisations
- Neoplasms (cancers).

This study used two approaches for assessing the health impact of social housing:

- A **tenancy duration** approach, which compared the health status of the HNZC pre-tenant applicant population with tenant populations during their first year, and for successive time periods. The time periods as tenants were measured according to the duration of their household tenancy rather than for individual household members.
- A **comparative cohort** approach, which followed individuals and compared their health status as HNZC applicants with their hospitalisations rates following placement in a HNZC house. To improve the ability of the study to draw causal inference, it further compared the tenant cohort with applicants placed on the HNZC waiting list who did not get allocated to social housing (unsuccessful applicants). The tenant population was further divided into those tenants who exited in under two years (early exit tenants) and those who stayed longer (long term tenants).

The study population included all HNZC applicants who completed a Needs Assessment and were placed on the waiting list from 2003 to 2008 and all tenants who submitted an IRR application over this same period (some of whom could have been tenants for many years). The analysis of health outcomes used linked hospitalisations for 2003 to 2008 (tenancy duration method) or from 2001 to 2008 (comparative cohort method).

## Results

The analysis of hospitalisations using the **tenancy duration** approach showed that tenant populations had markedly lower hospitalisation rates than pre-tenants for most health conditions.

- Compared with pre-tenant applicants, hospitalisation rates for tenants in their first two years were significantly lower for most major disease groups (based on ICD.10 chapters) including: Infectious and parasitic diseases (18.0%), mental and behavioural disorders (19.6%), musculoskeletal disease (26.3%), symptoms and signs (11.8%), injury and poisoning (15.5%) and factors influencing health status (55.0%).
- The total acute overnight hospitalisation rate was 10.6% less for tenants in their first 2 years, 12.8% less for Ambulatory Sensitive Hospitalisation (ASH), 12.0% for Population Preventable Hospitalisation (PPH), and 17.1% for Housing-Related Potentially Avoidable Hospitalisation (HR-PAH). Rates dropped by 13.6% for close-contact infectious diseases (CCID), and 13.1% for circulatory and respiratory diseases, 19.6% for mental and behavioural disorders, and 6.8% for home injuries.
- In general, hospitalisations for tenants decreased with tenancy durations. Rates decreased about 10%-30% after they moved to HNZC housing and during the first 3 years as tenants. There was some evidence of this decline reaching a plateau after 3+ years for close-contact infectious diseases, and circulatory and respiratory diseases.
- Some conditions showed a slightly different trend. Mental and behavioural disorder hospitalisations appeared to continue decreasing with household tenancy duration. The rate decreased 16.3% during tenancies of less than one year, 24.2% in the first year, 29.4% in second years, and up to 44.9% after 3+ years as tenants.
- While all injury hospitalisations decreased with increasing duration of tenancy, the decrease was slightly more marked for injuries outside the home (26.9% decline after 3+ years) than for injuries occurring at home (21.0% decline).

The analysis of hospitalisations for the **comparative cohort** focussed on the cohort of tenants who were aged 5-65 years at a time 2 years before housing allocation (or removal from the HNZC waiting list for unsuccessful applicants). This focus avoided the confounding effects of age (which inevitably rises with increasing time in the cohort). The comparison also focussed on long-term tenants (2+ years) compared with unsuccessful applicants (those not allocated a house). Rates were age and ethnicity standardised to ensure comparability between tenants and unsuccessful applicants.

- This analysis showed that unsuccessful applicants had lower hospitalisation rates than long-term tenants for all health conditions except for mental and behavioural disorders (where rates were marginally higher for unsuccessful applicants). These differences generally remained fairly consistent for the whole observation period.
- Both cohort groups had broadly similar hospitalisation trends across the different health indicators during the 4-year observation period. The cohort started from 2 years before pre-tenants became tenants (or unsuccessful applicants were removed from the HNZC waiting list). Hospitalisation rates gradually increased during this observation period reaching their highest level during the 6-month period before becoming tenants (or unsuccessful applicants were removed from the HNZC waiting list), then dropped significantly during the first 6 months as tenants (or following removal from the HNZC waiting list). Hospitalisation rates then tended to return to the previous 'baseline' levels that applied at the start of the observation period.
- We can use the 1-year period before pre-tenants became tenants (or unsuccessful applicants were removed from the HNZC waiting list) for comparison purposes. Using this baseline period, hospitalisations for Housing-Related Potentially Avoidable Hospitalisation (HR-PAH) dropped significantly over the following 2-years for long-term tenants but not for unsuccessful applicants. The same pattern was seen for injuries in places other than the home. By contrast, total acute and arranged hospital admissions fell more in the unsuccessful applicants than in long-term tenants. Circulatory and respiratory disease hospitalisations, mental and behavioural disorder hospitalisations all fell significantly for both cohort groups (ie for both long-term tenants and unsuccessful applicants).
- We can gain an indication of the medium to long-term impact of social housing by using the period 2-years before pre-tenants became tenants (or unsuccessful applicants were removed from the HNZC waiting list) for comparison purposes. These comparisons generally show that hospitalisation rates for the long-term tenants and unsuccessful applicants increased over this 4-year period, even after age and ethnicity adjustment. Exceptions were mental and behavioural disorders and injuries in places other than the home, which declined significantly, and to a larger extent, for long-term tenants.

## **Discussion and conclusion**

*Main findings* – This study confirmed previous observations that placement of housing applicants into social housing is associated with a significant drop in hospitalisation rates for almost all health outcomes. This association suggests that stable social housing may contribute to short-term health improvements for this vulnerable population.

However, the cohort analysis did not generally find a prolonged protective effect from allocation to social housing. The improvement in health status appeared to be, at least

partially, a consequence of a temporary period of worse health for this population while they were on the HNZN waiting list. When followed as a cohort, their acute hospitalisation rate dropped to a significantly lower rate within their first 6-months as a tenant. But this rate was usually similar to their previous 'baseline' rate observed retrospectively. This pattern could represent an example of 'regression to the mean'. With this phenomenon, those with relatively poor health status would experience an improvement over time with or without a change in housing. Placement in social housing may accelerate this return to improved health, but this possibility still needs further investigation.

Additionally, the experience of long-term tenants (those who apply for a house and remain in it for 2+ years) appeared similar to that seen for unsuccessful housing applicants. Both groups showed a short-term decline in hospitalisations following allocation to HNZN housing or removal from the HNZN waiting list in the case of unsuccessful applicants. Both groups also subsequently returned to approximately their baseline levels of hospitalisation.

However, for some conditions placement in social housing was associated with a sustained improvement in health. Hospitalisation rates for mental and behavioural disorders and some types of injury declined markedly following placement in social housing and these declines were sustained for the 2-year follow-up period. These declines were marginally more pronounced for long-term tenants than those seen for unsuccessful applicants. Importantly, Housing-Related Potentially Avoidable Hospitalisation (HR-PAH) dropped significantly over the following 2-years for long-term tenants but not for unsuccessful applicants.

*Implications* – Social housing applicants are a vulnerable group with high rates of hospitalisation and deteriorating health status leading up to the period when they apply for social housing. Placement in social housing is associated with marked improvements in health, as measured by declines in hospitalisation for a wide range of conditions suggesting positive short-term health effects. Medium to long-term health benefits from social housing are less certain.

Findings from this study provide support for HNZN's social allocation formula. Those prioritised to receive social housing appear to have consistently higher health needs than those who are not allocated to such housing.

*Limitations* – This further analysis of the SHOW cohort has a number of important limitations.

- It is restricted to those tenants who qualify for an income related rent (IRR) and complete an IRR application form each year. These households include 92.3% of tenancies (61,220 tenancies on IRR out of a total 66,315 in December 2009).
- The tenancy duration analysis is limited by a systematic gap in the recording of infants on the IRR form. The analysis here has shown that virtually no newborn infants in tenant households are recorded on RENTEL. Consequently, it is not possible to assess the impact of HNZN housing on the health of young children.
- The cohort analysis used a restricted age group (5-65 years) so that it could follow the same individuals over time and minimise the confounding effects of change in age. However, infants and children have the highest rates of hospitalisation and may be particularly vulnerable to poor housing conditions. As a result, this restriction reduces study power and generalisability. A specific analysis of hospitalisations rates by age group suggests that social housing is associated with a marked decline in

hospitalisations for children with increasing duration of time in social housing (but not for those 66+ years).

- The cohort analysis in particular is not a controlled trial where those receiving the intervention, or not receiving it, are decided by a careful randomisation process. Instead, the allocation is deliberately non-random and based on a highly developed social allocation system. Consequently, we cannot draw firm conclusions about the impact of social housing on those who received it by comparing them with those who did not, as by the HNZC inclusion criteria, unsuccessful housing tenants were less likely to have chronic illnesses and as low incomes as successful tenants.
- Similarly, we need to be cautious in conclusions we draw from observing changes in hospitalisation rates in tenants over time. There is considerable potential for ‘cohort effects’ caused by changes in the wider social, economic and health environment in New Zealand that may have taken place since the cohort was established in 2003. Changes in employment levels, the cost of living, and other external factors could alter hospitalisation rates over time independent of the effects of housing conditions. However, this report covers a stable period of economic growth and low employment, so this is not a major consideration at this stage.

*Further research* – We plan to repeat this analysis with a further year of cohort data, which will capture the impact of changing economic circumstances during 2009. This analysis will use multivariate methods to further assess the associations discussed here. We will consider using propensity scores or restricted analysis (based on housing priority ratings) as a way of improving the comparability of successful and unsuccessful housing applicants.

To improve the quality and usefulness of housing tenant data, HNZC could consider approaches to encourage tenants completing an IRR application to record details of all people in their households, including all newborn children.

## 2. Background

Housing tenure, whether a person rents or owns the house they live in, is known to have a marked effect on people's health. People who live in a house they own - in part or in full - have a major capital asset, which can financially and psychologically buffer them and their families throughout their lives. Those who rent, whether from a private landlord or a social housing agency, are likely to be poorer, although in some cases they may be trading off more income for less wealth [1].

There is strong evidence that people who own their own houses are in better physical health than people who rent their houses, even controlling for income [2]. It is not clear why homeownership seems better for health than renting, whether from social or private landlords. It may be that homeownership confers both psychological and material advantages upon owner occupants [3-4]. Psychologically, homeownership, rather than renting, is thought to confer greater autonomy on occupants, as well as social status [5], what economists call 'positional goods'. Materially, houses that are owned are generally in better condition than rented accommodation. Moreover, in general, houses are the largest capital asset owned by families and represent a measure of wealth, which can be used to generate a stream of income in addition to salary and wages.

The development of social housing was designed explicitly to counteract the generally poorer quality and greater insecurity of rental housing and racism in the private rental market [6]. Leases in social housing agencies such as HNZC have been designed to give all tenants, regardless of income, health status or ethnicity, security that approximates that given by a house title to an owner. However, the costs and benefits are not static, in part because the housing market is such a pivotal part of the general economy and in an economic recession, homeowners, who bought in a boom, may be left with negative equity in their houses [7-8]. In this case, homeownership may be *less* secure than renting, particularly if the homeowner is made unemployed or becomes chronically ill.

We know from New Zealand research that housing quality is one of the contributors to health inequalities. Cold, damp, mouldy housing affects people's health and well-being, as well as their use of health services [9-10]. In the United Kingdom, Blane and colleagues have outlined how housing conforms to the inverse care law first identified in health care [11]. Colder and windier parts of the United Kingdom have poorer housing, which is associated with reduced lung function, as well as raised diastolic and systolic blood pressure [12].

Furthermore, we know from earlier New Zealand research that the level of household crowding has a clear link to the transmission of infectious diseases [13]. Crowding is more common in low income households where people try to lower the rent per person by 'doubling-up' in households. At the other extreme, people in single-person households tend to have higher living costs and are more likely to suffer from fuel poverty, i.e. they spend more than 10% of their income on household energy [14]. Thus, the influences of housing on health inequalities are both direct and indirect [15].

Previous work in the United Kingdom has showed that social housing is an effective intervention to reduce inequalities in health [16]. This cohort study has been designed to evaluate the health impacts of social housing in New Zealand. It uses administrative data to monitor the effects on hospitalisation of social housing.

### 3. Introduction

This project aims to assess the health impacts of moving people from the Housing New Zealand Corporation (HNZC) waiting list to HNZC tenancies.

This project is part of a larger multi-year programme of work to measure the health impact of social housing. It builds on the established Social Housing Outcomes Worth (SHOW) Study, which links HNZC's housing applicants and tenants to their hospitalisation records via an encrypted National Health Index number. It also builds on a previous component of the project which has defined a set of Housing Sensitive Health Outcomes [17].

Previous work using the SHOW Study has found that [18]:

- Hospitalisation rates are significantly lower in HNZC tenants compared with housing applicants. This relative decline is particularly marked when comparing tenants with pre-tenant applicants (ie housing applicants who subsequently became housing tenants) who represent a more valid comparison group than total applicants.
- This apparent decline in hospitalisations becomes more pronounced with increased duration in social housing, reaching a low plateau after about 4 years.
- These relative declines in rates are larger for some categories of hospitalisation, notably respiratory diseases; injuries and poisonings; and infectious diseases.

### 4. Methods and study population

#### 4.1. Construction of the cohort

This prospective cohort study was established in collaboration with New Zealand's largest provider of social housing (Housing New Zealand Corporation). HNZC provides social housing for approximately 5.1% of the population (239,364 total tenants out of a current New Zealand population of 4,357,871). It manages about 4.2% of properties (67,621 properties out of 1,618,300 private occupied dwellings estimated by Statistics New Zealand in December 2009). In the process HNZC collects detailed information on housing applicants and tenants. The method is described below, and includes obtaining housing applicant and tenant data from HNZC, using these data to construct the cohort, linking to hospitalisation records, and analysis of this combined dataset.

This project builds on the results reported in the study, *Health Status of HNZC tenants and applicants: Key indicators for 2004-2008*. It also uses the parallel work on developing a set of housing sensitive health outcomes for measuring the effects of housing [17]. The project takes advantage of the increasing duration of the cohort study, which by the end of 2008 had 6 years of cohort time and linked hospitalisation data.

The study population included all HNZC applicants who completed a Needs Assessment and were placed on the waiting list from 2003 to 2008 and all tenants who submitted an IRR application over this same period (some of whom could have been tenants for many years). The analysis of health outcomes used linked hospitalisations for 2003 to 2008 for the tenancy duration method or from 2001 to 2008 for the comparative cohort method (see below for an explanation of these two approaches).

The main methods used for construction of the cohort were described in a previous report [19]. The study uses the fact that HNZC obtains and stores detailed records on all

applicants and tenants. Information on housing applicants is collected via a Needs Assessment (NA) semi-structured interview completed at the time of application for public housing. Information on housing tenants comes from a self-completed Income-Related Rent (IRR) form that is filled out by the majority of tenant households each year (the 92.3% claiming IRR), or more often if their circumstances change. These administrative processes allow collection of demographic variables (age, sex, ethnicity), some housing environment information (crowding based on number of people and number of bedrooms) and confounders (household income). A voluntary smoking question was added to the IRR form for completion by adult household members.

## **4.2. Health outcomes and analysis**

This research uses hospitalisation data collated by the Ministry of Health (MoH) as the basis for measuring health outcomes. The MoH obtains coded data on all publicly funded hospital admissions in New Zealand. These data include a unique health sector identifier, the National Health Index (NHI) number for all hospitalised individuals. Data on total housing applicants and tenants were transferred from HNZC to MoH for matching with individual NHI numbers using identifying information (first given name, surname, sex, and date of birth). The MoH supplied the researchers with the HNZC file along with the NHI for each cohort member where this could be identified. To ensure confidentiality, the names of participants were removed and the NHI was encrypted. The MoH also supplied the researchers with the file of all hospital discharges for New Zealand with the encrypted NHI for each hospitalisation. This process enabled the researchers to anonymously link hospitalisations to cohort members.

Hospitalisation data were filtered to exclude health events that had little or no relationship to the research questions being investigated, and to maximise the consistency of data for making comparisons over time and across different regions. This filtering selected publicly funded, New Zealand resident, acute and arranged, hospitalisations. In most instances these were also overnight hospitalisations and excluded readmissions for the same condition (within 28 days). A broadly similar filtering approach has been used during the analysis of New Zealand injury hospitalisations [20]. Analysis was based on the principal diagnosis as coded using the International Statistical Classification of Diseases version 10 (ICD.10).

Several of the analyses used ICD.10 chapters. However, most were based on a defined set of Housing Sensitive Health Outcomes developed for measuring the impact of housing on aspects of health [17]. These conditions are listed in the appendix (10.1) and several are also described below:

- Total acute and arranged hospitalisations - Included all hospitalisations for illness and injury (consequently it excludes some specific ICD.10 chapters: pregnancy, childbirth and puerperium (O00-O99), certain conditions originating in perinatal period (P00-P96), congenital malformations, deformities and chromosomal abnormalities (Q00-Q99), and factors influencing health status and contact with health services (Z00-Z99). Filtering follows the standard approach, except that day cases and readmissions within a month were retained to give the broadest possible measure of hospitalisations.
- Total potentially avoidable hospitalisations (PAH) – Uses a Ministry of Health set of ICD.10 codes for conditions where hospitalisation is considered to be potentially preventable [21-23]. PAH include both of Ambulatory Sensitive Hospitalisations (ASH) and Population Preventable Hospitalisations (PPH). ASH are the subset that result from diseases sensitive to prophylactic or therapeutic interventions deliverable in

a primary health care setting (e.g. vaccine-preventable diseases, mammography for early breast cancer, effective glycaemic control in diabetics). They are considered a good indicator of access to primary health care health services. Population Preventable Hospitalisations (PPH) are the subset that result from diseases preventable through population-based strategies (e.g. smoke-free laws, housing improvements, better road safety). PPH provide an indication of the extent that this population is being reached by public health programmes.

- Housing Related Potential Avoidable Hospitalisations (HR-PAH) – This is a subset of PAH that are considered sensitive to housing conditions[24]. It therefore has the potential to provide a single indicator of the health impact of housing conditions. Filtering follows conventions used by the MoH for calculating the ASH component of PAH.
- Close contact infectious diseases (CCID) - These are based on diagnostic codes for diseases attributed to infection [25]. This grouping is further restricted to those infectious diseases that may be transmitted by person-to-person contact. This indicator is restricted to the infections themselves rather than their late effects.
- Circulatory and respiratory disease hospitalisations – This grouping uses ICD.10 codes for circulatory and respiratory diseases: I00-I99, J00-99
- Mental and behavioural disorder hospitalisations - This grouping uses ICD.10 codes for mental and behavioural disorders: F00-F99.
- Home injury hospitalisations - This grouping uses ICD.10 codes for injury hospitalisations (S00-T99). Occurrence at home is identified by an additional E-code (4th digital is 0 in ICD.10 v1, or Y920 in ICD.10 V2&3).

In addition, it used two other categories of health event that are considered less likely to be related to housing conditions, at least in the short term:

- Non-home injury hospitalisations: This grouping uses ICD.10 codes for injury hospitalisations (S00-T99). It excludes all injuries occurring at home as identified by an additional E-code (4th digital is 0 in ICD.10 v1, or Y920 in ICD.10 V2&3).
- Neoplasms (cancers): C00-D48.

The analysis in this report describes social housing applicant and tenant hospitalisations using standard methods for calculating crude and adjusted rates, rate ratios and confidence intervals [26]. Most rates have been age-standardised (using nine age groups: 0-4, 5-9, 10-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70+) and ethnicity-standardised (using three prioritised ethnic groups: Maori, Pacific, Other [including European, Asian, MELAA - Middle Eastern/Latin American/African, Other and Not stated]) to the age-ethnicity structure of the total cohort population at December 2006. This report describes the changes in hospitalisation rate (cases per 1,000 population per year) associated with the move from HNZC applicant to tenant status.

This study used two broad approaches for accessing the health impact of social housing: A **tenancy duration** approach and a **comparative cohort** approach. These approaches are described in more detail below.

### **4.3. Tenancy duration approach**

This approach compares the health status of the pre-tenant applicant **population** (ie housing applicants who subsequently became housing tenants) with the **population** of housing tenants during their first year as tenants, and successive duration as tenants (<1 year, 1 year, 2 years, 3+ years). The time periods as tenants were measured according to their **household** tenancies rather than for **individual** tenants. This component aimed to identify which health outcomes appeared to be most sensitive to the effects of moving into social housing and the duration of social housing.

Pre-tenant applicants (the applicants who became tenants during January 2003 to December 2008) and tenants (whose household tenancies started during January 2003 to December 2008) were included in this approach. The household tenancy durations were used. To allow robust analysis of findings from this population, some research restrictions and conventions were applied:

- Time gaps in an individual's records of less than 2 years were connected. For example, a person might appear as an applicant from March 2007 to September 2007, then start as an applicant again from May 2008 to October 2008 (record gap of about 7 months), and then be housed in October 2008. In this instance, we have made a research assumption that the person was an applicant from March 2007 to October 2008 without a break.
- Tenants could stay as tenants or exit as tenants during the observed period. If tenants exited tenancies and became HNZN applicants again (for example, transfer tenants) they were excluded from this analysis because of potential uncertainties about their tenure.
- Pre-tenant applicants, who were recorded as staying on the HNZN waiting list for less than three months, before moving into a HNZN house, were assumed to have been living in that housing situation for three months. Hospitalisations and person time for that 3-month period were then used for estimating hospitalisation rates for the pre-tenant period. About half of pre-tenant applicants were on the HNZN waiting list less than 3 months. This 3-month figure was based on data recorded on the needs assessment interview sheet in response to the question "How long, in weeks, have you been living in this situation, i.e. with this number of people in your current house". The median period reported was 3 months.
- People who died during the observation period 2003 to 2006 were excluded (452 died during 2004-2006, mortality data not yet available for 2007-2008).

The number of people and amount of person time as pre-tenant applicants and tenants, for each duration, is shown in Table 4.1. The number of tenants with a tenancy duration of less than 1 year was more than the number of pre-tenant applicants because some people joined the tenancy households directly without going through the application path. These households would have included market renters who applied for Income Related Rent and children born into tenant households.

**Table 4.1: Person time as pre-tenant applicants and tenants included in the tenancy duration analysis, 2003-2008**

Tenancy duration	Number of people	Median time in each period (days)	Mean time in each period (days)	Person years
Pre-tenant waiting list	64,066	86	171.8	31,397.7
Tenancy <1 years	72,362	365	307.5	64,288.4
Tenancy 1 year	61,734	365	296.7	51,772.0
Tenancy 2 years	43,410	365	284.0	36,085.6
Tenancy 3+ years	27,877	387	419.5	34,312.6

NB. Person time is used as the denominator for calculating hospitalisation rates

We have also analysed the priority rating given to households in this population (Table 4.2). This analysis shows that the majority of such households were given a B priority rating. However, the population also included moderate numbers of high priority A households and lower priority C and D households.

**Table 4.2: Priority rating, at first registered time, of pre-tenant applicants included in the tenancy duration analysis, 2003-2008**

Priority rating	Number of Household	Percent (%)	Number of people	Percent (%)
Missing	7	0.0	22	0.0
A	2,715	9.8	7,861	12.3
B	17,633	63.8	40,952	63.9
C	5,625	20.4	11,964	18.7
D	1,643	6.0	3,267	5.1
<b>Total</b>	<b>27,623</b>	<b>100.0</b>	<b>64,066</b>	<b>100.0</b>

NB. This tenancy duration approach includes only successful housing applicants (ie those allocated social housing who subsequently became tenants)

#### **4.4. Comparative cohort approach**

This approach follows **individuals** and compares their hospitalisations rates as housing applicants with their rates following re-housing of varying duration. Consequently it can measure the time periods as tenants for **individual** tenants rather than relying on the duration of household tenancies.

We have chosen this subset of tenants because we can follow them as individuals and identify their person time as pre-tenant applicants and as tenants. For tenants without applicant records, we cannot be sure of their tenant durations since we don't know when they individually started as tenants. HNZA's administrative database, RENTEL, only records the household tenancy lease start date, rather than the start date for individuals. Consequently, the longest this analysis can have followed anyone is about 6 years, but this

period will extend as the duration of the cohort study increases. This population, therefore, included the cohort of pre-tenant applicants and tenants that had the potential to be tenants for 2+ years (people whose needs assessment interviews were in 2003-06 and had tenancy 2+ years up to 2008). As the person times for pre-tenant applicants were extended to 2 years before being housed, the observation period for hospitalisations using this method is from January 2001 to December 2008.

To improve the ability of the study to draw causal inference, it further compared the tenant cohort with applicants placed on the HNZN waiting list who did not get allocated to social housing during 2003 to 2008 (unsuccessful applicants). The tenant population was further divided into those tenants who exited in under 2 years (early exit tenants) and those who stayed longer (long-term tenants). These refinements aimed to investigate: (i) whether the effect was a form of reverting to the mean where those who didn't get allocated to social housing also had an improvement in health over time, and (ii) identify whether the association of improved health with social housing was a selection effect (eg where the observed health improvement of tenants over time could be caused by those with poorer health also having less stable lives and tending to exit HNZN housing sooner than those with better health).

To allow robust analysis of findings from this population, some research restrictions and conventions were applied:

- Time gaps in individual's records of less than 2 years were connected. For example, a person might appear as an applicant from March 2007 to September 2007, then start as an applicant again from May 2008 to October 2008 (record gap of about 7 months), and then be housed in October 2008. In this instance, we would assume the person was an applicant from March 2007 to October 2008 without a break.
- Tenants could stay as tenants or exit as tenants during the observation period. If tenants exited tenancies and became HNZN applicants again (for example, transfer tenants) they were excluded from this analysis because of potential uncertainties about their tenure.
- People who died during the observation period 2003 to 2006 were excluded (452 died during 2004-2006, mortality data not yet available for 2007-2008).
- For tenants, we used the date of assignment to a HNZN house as the key reference date for calculating the timing of the observation period (ie two years before and two years after). For unsuccessful applicants, we assigned all of them a reference date that was 120 days after the date of their housing application. This time interval was based on the median waiting time for successful housing applicants to produce results that were comparable (with the successful tenants).
- We restricted the cohort to those aged 5 to 65 years of age at entry to the cohort, 2 years before the reference date, to reduce the confounding effects of increasing age in the cohort.
- Unsuccessful applicants were people who were placed on the HNZN waiting list and who did not get allocated to social housing during the observation period 2003 to 2008 (unsuccessful applicants with their NA interviews in 2003 to 2006 were used).

The numbers of people as pre-tenant applicants and tenants at each duration are shown in Table 4.3. There were 39,902 people who applied for HNZC houses during the 2003-2006 period, but were not successful up to December 2008. The median time these unsuccessful applicants stayed on the HNZC waiting list was 273 days. There were 39,793 people who applied for HNZC houses and were successfully housed during 2003-2006. Most tenants (31,843 people) stayed for 2+ years so were classed as long-term tenants (80.3 % of those assessed in 2003-06). Following these tenants to the end of 2008, the long-term tenants spent a median of 96 days as applicants and 1,272 days as tenants. The early exit tenants spent a median of 83 days as applicants and 415 days as tenants.

**Table 4.3: Numbers and duration as applicants and tenants, included in the comparative cohort analysis, 2003-2008**

Category	No. of people	Median time (days)	Mean time (days)
<b>Unsuccessful applicants (2003-2006)</b>	39,902		
Time as applicants		273	441
<b>Early exit tenants (&lt;2 years)</b>	7,945		
Time as applicants		83	181
Time as tenants		415	424
<b>Long term tenants (2+ years)</b>	31,848		
Time as applicants		96	212
Time as tenants		1,272	1,311
<b>Total tenants (=successful applicants 2003-2006)</b>	39,793		
Time as applicants		92	189
Time as tenants		1,111	1,138

We have also analysed the priority ratings given to households in this cohort population (Table 4.4). This analysis shows, not surprisingly, that the successful tenant population has a very similar distribution of priority ratings to those seen for the tenancy duration approach described earlier (Table 4.2). However, the unsuccessful applicants have a much lower proportion of high priority A and B households than was seen for the successful applicants.

**Table 4.4: Priority rating, at Needs Assessment, of applicants included in the comparative cohort analysis, 2003-2006\***

Applicants in 2003-2006*	No. of Households	Priority rating (%)				No. of people	Priority rating (%)			
		A	B	C	D		A	B	C	D
Unsuccessful applicants	20,072	2.7	43.9	36.7	16.8	39,902	3.1	44.6	36.2	16.1
Early exit tenants (<2 years)	4,765	10.8	63.8	19.9	5.4	7,945	12.2	63.4	19.2	5.2
Long term tenants (2+ years)	14,240	9.9	64.0	20.2	5.9	31,848	12.5	63.9	18.5	5.0
<b>Total tenants (=successful applicants)</b>	19,005	10.1	64.0	25.2	5.8	39,793	12.5	63.8	23.0	5.0

\* The comparative cohort analysis was restricted to applicants over the 2003-2006 period because of the need for two years of follow-up hospitalisation data.

## 5. Demographic and socio-economic characteristics

This section presents key demographic and socio-economic characteristics of the HNZN population. These indicators are based on information reported through the IRR form and NA interview and recorded in RENTEL. All of these characteristics will change depending on the point in time at which they are measured and the population used (eg pre-tenant applicants at the point of shortly before becoming tenants, tenants at the start of their tenancy and after tenancies of varying durations, early exit tenants, long-term tenants, unsuccessful applicants).

To simplify this analysis, we have focused on presenting the characteristics of tenants (at start of tenancy). This population provides a reasonable indication of the characteristics of the cohort population overall.

In addition, we have included analyses for some selected characteristics for pre-tenant applicants at the point of shortly before becoming tenants. This has been done for two characteristics that are known to change considerably for tenants: household crowding and household income. We have also presented an analysis of active and passive smoking for tenants as these data are not available for housing applicants.

### 5.1. Age and sex

Table 5.1 shows the very youthful nature of the HNZN population. The median age was 15 years, which was considerably younger than the total New Zealand population median of 35 years. The proportion of people 65+ years was about quarter of the New Zealand average. The proportion of females was consistently higher than the New Zealand population.

**Table 5.1: Age and sex distribution for tenants (at start of tenancy), 2003-2008**

Age and Sex	Tenants (at start of tenancy)				NZ Census 2006*			
	Female	Male	Total	%	Female	Male	Total	%
Mean age (years)	22.9	19.6	21.4	-	-	-	-	-
Median age (years)	20	12	15	-	36.7	35.1	35.9	-
0-4 years	7,014	7,551	14,565	22.7	134,698	140,379	275,076	6.8
5-17 years	9,710	10,214	19,924	31.1	-	-	778,602	19.3
5-19 years	-	-	-	-	436,611	456,081	-	-
18-64 years	17,612	9,828	27,440	42.8	-	-	2,478,675	61.5
20-64 years	-	-	-	-	1,216,551	1,148,010	-	-
65+ years	1,118	1,019	2,137	3.3	274,461	221,139	495,606	12.3
<b>Total</b>	<b>35,454</b>	<b>28,612</b>	<b>64,066</b>	<b>100.0</b>	<b>2,062,397</b>	<b>1,965,618</b>	<b>4,027,947</b>	<b>100.0</b>

- Not available / Not applicable

\* Confidentiality rules have been applied to Census data, including randomly rounding to base 3, so individual figures may not add up to totals

## 5.2. Ethnicity

Table 5.2 shows the ethnicity distribution of tenants at the start of their tenancies in prioritised and total formats. Prioritised ethnicity is used in the calculation of age-ethnicity standardised hospitalisation rates as it groups people without double counting. Total ethnicity is usually used by Statistic New Zealand to present ethnicity distributions for the New Zealand population. Total ethnicity includes all of the people who stated each ethnic group, whether as their only ethnic group or as one of several ethnicities. Individuals may therefore be counted more than once so the total percentage of responses in the table will be greater than 100%.

Tenants contained 44.0% Māori, a proportion that was 3 times higher than the total New Zealand population, and 26.0% Pacific people, 4 times higher than the proportion in the total New Zealand population.

**Table 5.2: Distribution of ethnicity for tenants (at start of tenancy) , showing the analysis by prioritised and total ethnicity, 2003-2008**

Ethnicity	Tenants (at start of tenancy)				NZ census 2006			
	Prioritised ethnicity		Total ethnicity		Prioritised ethnicity		Total ethnicity	
	No.	%	No.	%	No.	%	No.	%
Māori	28,183	44.0	28,183	44.0	565,329	14.0	565,329	14.0
Pacific	15,292	23.9	16,641	26.0	226,293	5.6	265,974	6.6
Asian	2,985	4.7	3,227	5.0	340,812	8.5	354,549	8.8
European / Other	16,828	26.3	20,819	32.5	2,727,732	67.6	-	-
Not stated	778	1.2	778	1.2	167,784	4.3	167,784	4.2
<b>Total</b>	<b>64,066</b>	<b>100.0</b>	<b>64,066</b>	<b>108.7</b>	<b>4,027,947*</b>	<b>100.0</b>	<b>4,027,947</b>	<b>-</b>

- Not applicable

\* Confidentiality rules have been applied to Census data, including randomly rounding to base 3, so individual figures may not add up to totals

## 5.3. Household income

The sum of income field (from Needs Assessment and IRR records) measures total weekly household income that is relevant to the calculation of the income-related rent. Jensen equivalised income weights are used to adjust for household size and composition (adults and children)[27]. The household income is adjusted by dividing the weekly income by the appropriate weight for the number of adults and children in a household. Table 5.3 confirms the very low median household income of the HNZC pre-tenant applicants and tenants at the start of their tenancies. Equivalised household income (median of \$218.5 weekly), which is adjusted by number of adults and children in households, is even lower.

**Table 5.3: Household weekly income for pre-tenant applicants and tenants (at start of tenancy), 2003-2008**

	Pre-tenant applicants		Tenants (at start of tenancy)	
	Income (\$)	Equivalised income (\$)	Income (\$)	Equivalised income (\$)
<b>Mean</b>	293.1	236.8	294.7	233.8
<b>90% of maximum</b>	445.1	346.7	446.2	343.4
<b>Upper quintiles</b>	313.6	274.6	318.4	274.0
<b>Median</b>	255.8	221.6	256.5	218.5
<b>Lower quintiles</b>	241.5	180.2	241.5	175.5
<b>10% of minimum</b>	208.6	150.3	209.5	147.4
<b>Number of people</b>	64,066		64,066	

- Not available

#### **5.4. Household structure**

Table 5.4 presents the household structure by households and individuals. These data show that the largest proportion of the cohort were living in single parent households (48.7% for households and 52.5% for individuals), followed by couples with children (20.0% for households and 29.9% for individuals), then adults without children (31.3% for households and 17.6% for individuals). A small proportion of children age 0-17 (2.1%) was recorded as living on their own which. This group includes 16-17 year olds who have married and have their own children.

**Table 5.4: Household types for tenants (at start of tenancy), 2003-2008**

	Single with children (1+)		Couple with children (1+)		Adults (couple, single under 24 and 25 above)		Total	
	Number	%	Number	%	Number	%	Number	%
<b>Households</b>	13,129	48.7	5,383	20.0	8,443	31.3	26,955	100.0
<b>Individuals</b>	33,622	52.5	19,155	29.9	11,289	17.6	14,565	100.0
0-4 years	9,472	65.0	4,558	31.3	535	3.7	19,924	100.0
5-17 years	12,986	65.2	6,080	30.5	858	4.3	27,440	100.0
17-64 years	11,062	40.3	8,326	30.3	8,052	29.3	2,137	100.0
65+ years	102	4.8	191	8.9	1,844	86.3	64,066	100.0

#### **5.5. Active and passive smoking**

An average of 39.1% of the cohort population 18 years of age or more who responded to the smoking questions reported being smokers ie one or more a day (Table 5.5). This was higher than the prevalence reported by the 2006 Census for New Zealanders as a whole (20.7% for those 15 years and over).

**Table 5.5: Active smoking for tenants (at start of tenancy) (18+ years), 2003-2008**

Pre-tenant applicants (18+ years)	Tenants (at start of tenancy)				NZ census 2006 (15+)	
	No. of smokers	No. tenants providing smoking information	Smokers %	Smoke response %	Smokers %	Smoke response %
18-64 years	6,135	14,722	41.7	53.7	-	-
65+ years	146	1,327	11.0	62.1	-	-
<b>Total</b>	6,281	16,049	39.1	54.3	20.7	94.8

- Not available

Living in a household containing smokers was a relatively common exposure (Table 5.6). When smoking status was reported, over half the cohort population (51.0%) were exposed to second-hand smoke.

**Table 5.6: Passive smoking for people in the households of tenants (at start of tenancy), 2003-2008**

Pre-tenant applicants	Number of passive smokers	Number of tenants providing smoking information	Passive smokers %
0-4 years	4,192	7,800	53.7
5-17 years	5,726	11,001	52.0
18-64 years	7,534	14,510	51.9
65+ years	236	1,227	19.2
<b>Total</b>	17,688	34,538	51.2

## 5.6. Household crowding

Table 5.7 shows that household crowding was a relatively common exposure in the households of the cohort population, compared with other New Zealanders. The household crowding of pre-tenant applicants was markedly reduced after they were housed, from 43.2% to 3.8% for those exposed to a 2+ bedroom deficit, and 66.0% to 16.2% for those exposed to a 1+bedroom deficit. These levels remained higher than for total New Zealanders for 1+ bedroom deficit (10.0%). The numbers of households were not equal, as individuals may have lived in different households during applicant and tenant periods. A higher proportion of children were exposed to household crowding than adults.

**Table 5.7: Household crowding for pre-tenant applicants and tenants (at start of tenancy), 2003-2008**

	Pre-tenant applicants				Tenants (at start of tenancy)			
	No deficit %	1+ bed room deficit %	2+ bed room deficit %	Total numbers	No deficit %	1+ bed room deficit %	2+ bed room deficit %	Total numbers
<b>Households</b>	<b>41.7</b>	<b>58.3</b>	<b>34.7</b>	<b>27,028</b>	<b>87.6</b>	<b>12.4</b>	<b>3.6</b>	<b>26,995</b>
<b>Individuals</b>	<b>34.0</b>	<b>66.0</b>	<b>42.3</b>	<b>64,066</b>	<b>83.8</b>	<b>16.2</b>	<b>3.8</b>	<b>64,066</b>
0-4 years	24.5	75.5	49.7	14,570	83.4	16.7	4.6	14,565
5-17 years	26.5	73.5	50.2	19,915	77.8	22.3	4.2	19,924
18-64 years	41.5	58.5	34.9	27,449	87.6	12.4	3.2	27,440
65+ years	72.0	27.8	14.4	2,132	94.6	5.4	2.0	2,137
<b>NZ census</b>								
Household (2001)	-	5.1	1.2	-	-	5.1	1.2	1,276,235
Individuals (2006)	-	10.0	3.5	-	-	10.0	3.5	-

- Not available

## **6. Hospitalisations in the tenancy duration approach**

This section of the report presents a comparison of hospitalisation rates for pre-tenant housing applicants and tenants. The analyses apply to the observation period from January 2003 to December 2008 and present two broad types of comparisons:

- A comparison of pre-tenants with tenants during their first 2 years (based on person time and including tenants who exited in < 2 years) for ICD.10 disease chapters and key indicator conditions.
- A comparison of hospitalisation rates based on the duration of household tenancy, for single years (<1, 1, 2, 3+ years) for key indicator conditions.

### **6.1. Hospitalisation rates for pre-tenants and tenants**

The following graphs show a comparison of hospitalisations rates for housing tenants during their first 2 years as tenants (based on the duration of the tenancy) compared with rates seen in the pre-tenant applicant population. The tables on which these graphs are based are included in the appendix. These rates have been age-ethnicity standardised to adjust for differences in the age and ethnic make up of the applicant and tenant populations.

This analysis has been carried out for:

- ICD.10 chapters (n=15)
- Housing sensitive health outcomes (n=28)

#### **6.1.1. ICD.10 chapters**

Hospitalisation rate ratios, between pre-tenant applicants and tenants during their first 2 years, across ICD.10 chapters, are shown in Figure 6.1. Rates for the majority of hospitalisations decreased significantly after pre-tenant applicants became tenants, including infectious and parasitic (18.0%), mental and behavioural disorders (19.6%), musculoskeletal (26.3%), injury and poisoning (15.5%), respiratory (18.0 %), symptoms and sign (11.8%), and factors influencing health status (55.0%). The only increase was seen for digestive diseases, which showed a small (3.7%) and non-significant increase.

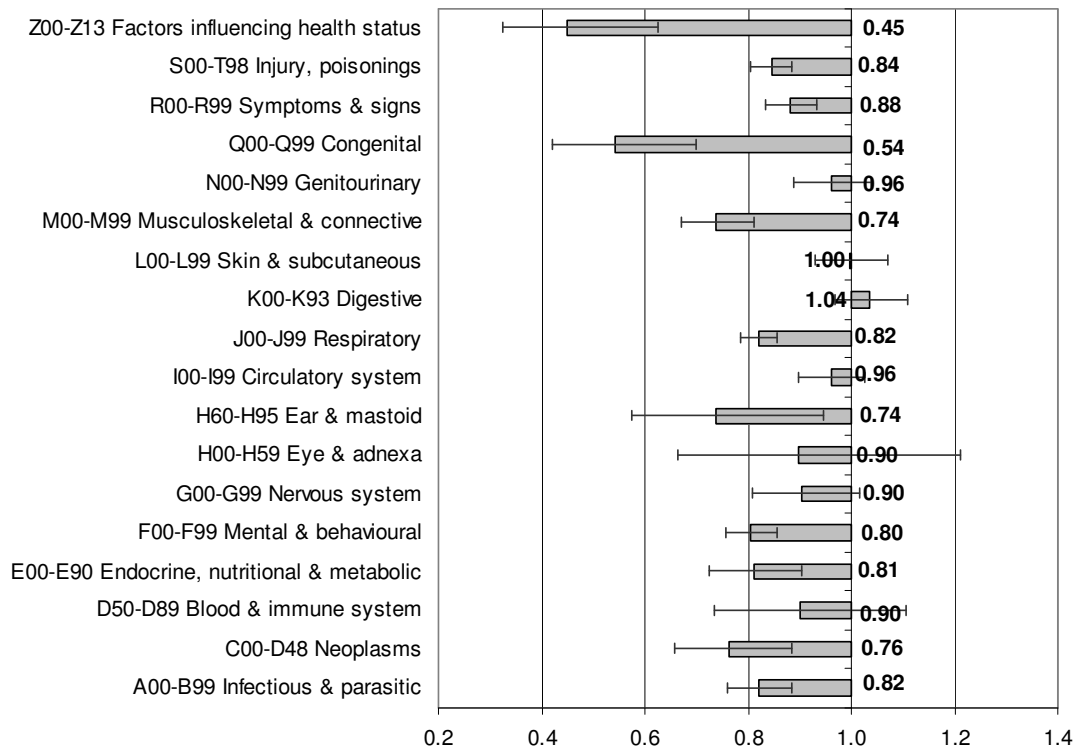
#### **6.1.2. Housing sensitive health outcome**

Housing sensitive health indicators and corresponding filters are listed in the appendix. Figure 6.2 shows the hospitalisation rate ratios between pre-tenant applicants and tenants for total acute and arranged hospitalisations, ASH, PPH and HR-PAH. Hospitalisation rate ratios for specified diseases are shown in Figure 6.3, Figure 6.4, Figure 6.5, and Figure 6.1.

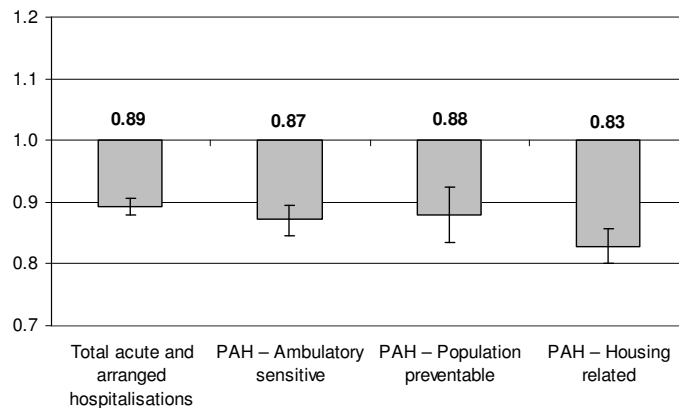
This analysis showed that tenants had significantly lower rates of hospitalisation than pre-tenant applicants for most health conditions. The total acute hospitalisation rates decreased significantly for tenants in their first two years (10.6%), for ASH (12.8%), for PPH (12.0%), and for HR-PAH (17.1%) (Figure 6.2). Rates were lower for CCIDs generally,

and specifically for meningitis and septicaemia (<18 year olds) (41.5%), and bronchiolitis (<5 years)(65.1%). Rates were lower for circulatory and respiratory disease in general (13.1%) and for asthma (21.2%), and for mental and behavioural disorders in general (19.6%), and suicide attempts (19.2%). However, there was only a small decline (not significantly 6.8%) for home injuries in general. There was a null or small changes in rates for influenza and pneumonia, skin diseases, fall at home.

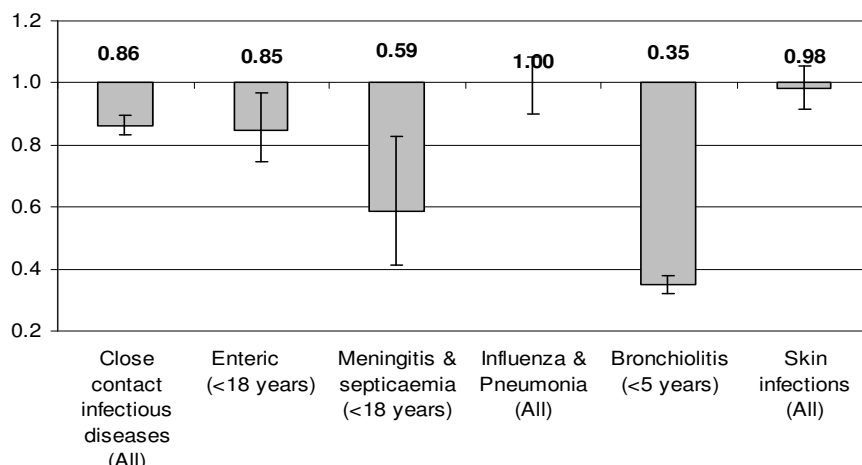
**Figure 6.1: Hospitalisation rate ratios for HNZC tenants during their first 2 years compared with pre-tenant applicants, based on ICD.10 chapters, age-ethnicity standardised (with 95% CI)**



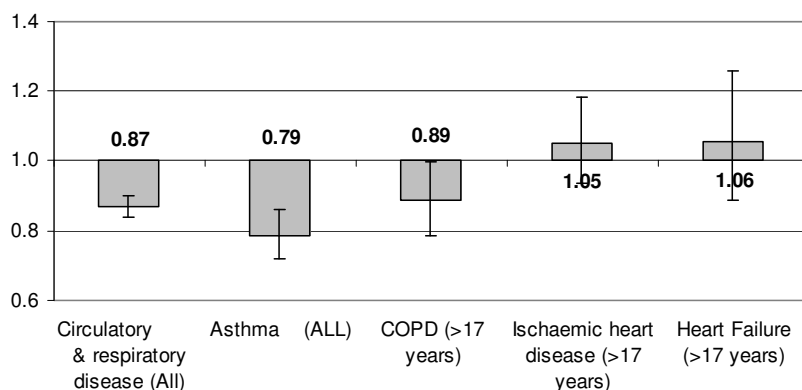
**Figure 6.2: Housing sensitive health conditions hospitalisation rate ratios for tenants during their first 2 years compared with pre-tenant applicants, age-ethnicity standardised (with 95% CI)**



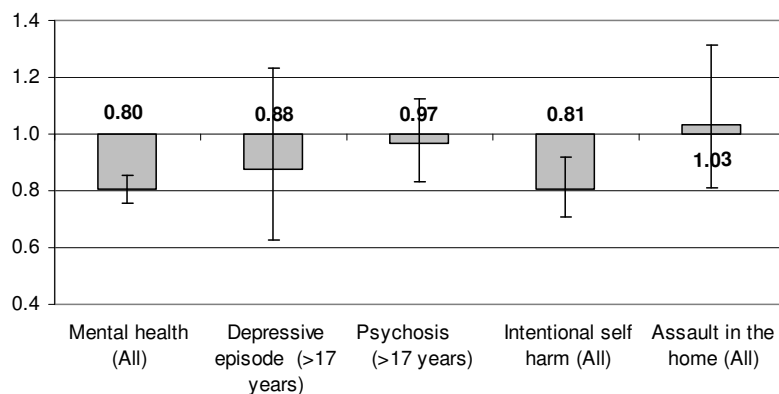
**Figure 6.3: Infectious disease hospitalisation rate ratios for HNZN tenants during their first 2 years compared with pre-tenant applicants, age-ethnicity standardised (with 95% CI)**



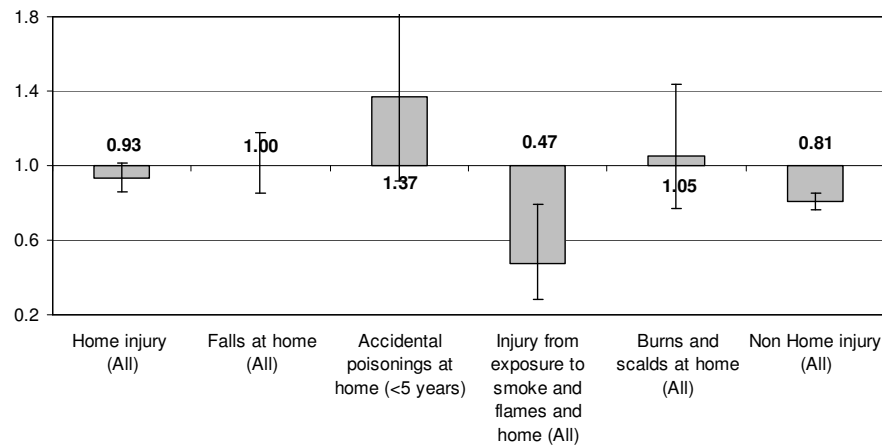
**Figure 6.4: Cardiovascular and respiratory disease hospitalisation rate ratios for tenants during their first 2 years compared with pre-tenant applicants, age-ethnicity standardised (with 95% CI)**



**Figure 6.5: Mental and behavioural disorder hospitalisation rate ratios for HNZN tenants during their first 2 years compared with pre-tenant applicants, age-ethnicity standardised (with 95% CI)**



**Figure 6.6: Home injury hospitalisation rate ratios for HNZN tenants during their first 2 years compared with pre-tenant applicants, age-ethnicity standardised (with 95% CI)**



## 6.2. Hospitalisation rates for housing-related conditions

The following graphs show a comparison of hospitalisation rates for HNZN tenants of varying duration with rates seen in the pre-tenant applicant population. The tables on which these graphs are based are included in the appendix. These rates have been age-ethnicity standardised to adjust for differences in the age and ethnic make up of the pre-tenant applicant and tenant populations.

This analysis has been carried out for the following seven disease and injury categories which are plausibly related to housing conditions (see methods section):

- Total acute and arranged hospital admissions
- Total potentially avoidable hospitalisations
- Housing-related potentially avoidable hospitalisations,
- Close contact infectious diseases
- Circulatory and respiratory disease hospitalisations
- Mental and behavioural disorder hospitalisations
- Home injury hospitalisations.

In addition, it used two other categories of health event that are considered less likely to be related to housing conditions, at least in the short term:

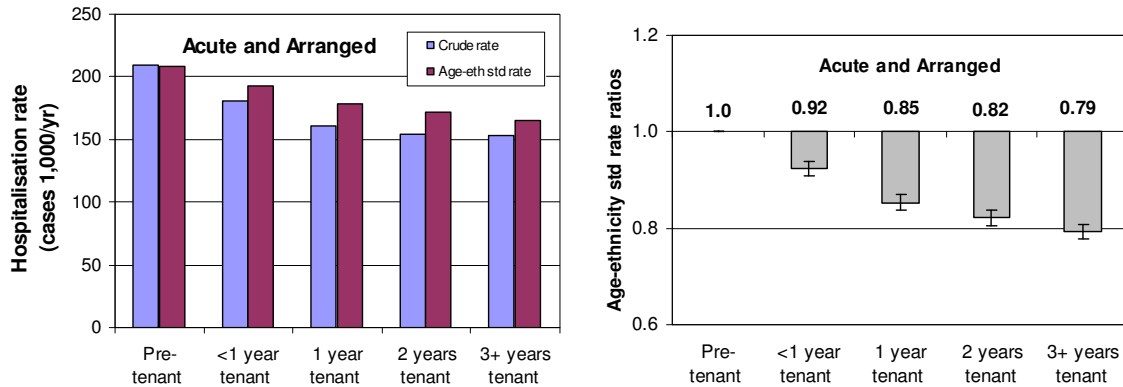
- Non-home injury hospitalisations
- Neoplasms (cancers).

### 6.2.1. Total acute and arranged hospital admissions

Total acute and arranged hospitalisation rates and rate ratios are shown in Figure 6.7. The hospitalisation rate decreased with tenancy duration. After age-ethnicity standardisation, the rate ratios to pre-tenants declined progressively, being 0.92 during the period up to 1

tenancy year, 0.85 in the first tenancy year, 0.82 in the second tenancy year, and 0.79 in 3+ tenancy years.

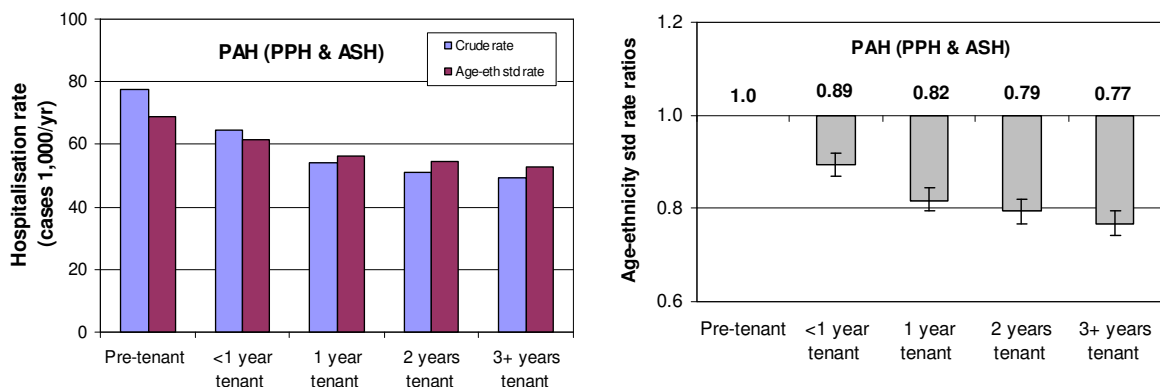
**Figure 6.7: Acute and arranged hospitalisation rates and rate ratios for pre-tenant applicants and tenants of varying durations (based on household)**



### 6.2.2. Total potentially avoidable hospitalisations

The PAH hospitalisation rate decreased with tenancy duration, as shown in Figure 6.8. After age-ethnicity standardisation, the rate ratios to pre-tenants are 0.89 during the first period up to 1 tenancy year, 0.82 in the first tenancy year, 0.79 in the second tenancy year, and 0.77 in 3+ tenancy years.

**Figure 6.8: PAH hospitalisation rates and rate ratios for pre-tenant applicants and tenants of varying durations (based on household)**

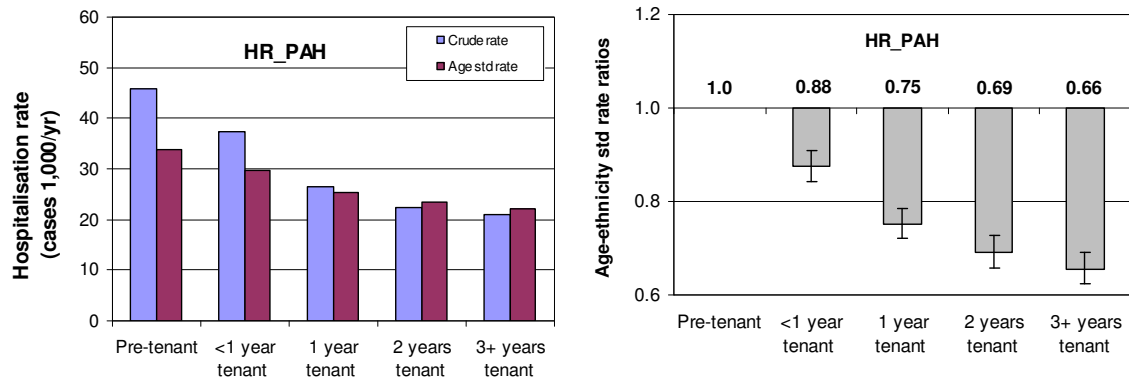


### 6.2.3. Housing-related potentially avoidable hospitalisations

Figure 7.9 shows that the HR-PAH hospitalisations decreased with tenancy durations. After age-ethnicity standardised, the rate ratios of pre-tenant applicants are little changed (0.88)

during the first period up to 1 tenancy year, 0.75 in the first tenancy year, 0.69 in the second tenancy year and 0.66 in 3+ tenancy years.

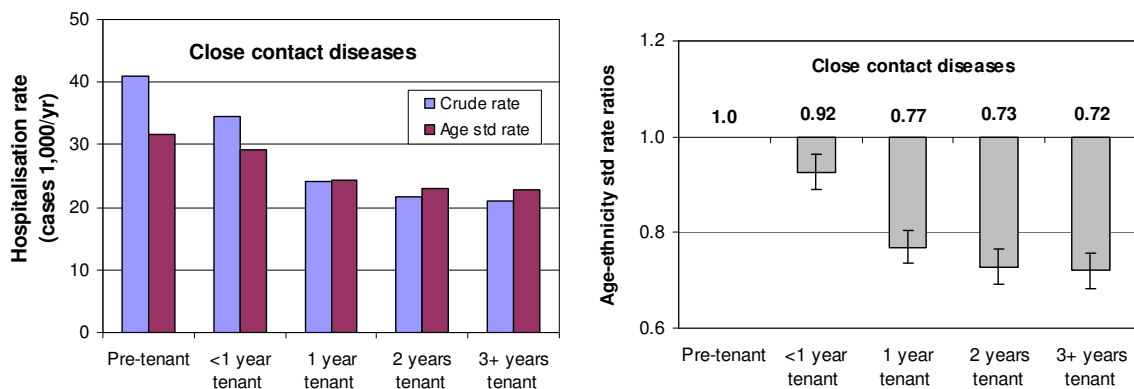
**Figure 6.9: HR-PAH hospitalisation rates and rate ratios for pre-tenant applicants and tenants of varying durations (based on household)**



#### 6.2.4. Close contact infectious diseases

The rate of close contact infectious diseases declined after pre-tenant applicants moved to HNHC houses (RR=0.92), and this decline continued during their first year (RR=0.77) and second years (RR=0.73) as tenants. The rate ratio flattened after 3+ years duration of the household tenancy (RR=0.72).

**Figure 6.10: Close contact infectious disease hospitalisation rates and rate ratios for pre-tenant applicants and tenants of varying durations (based on household)**

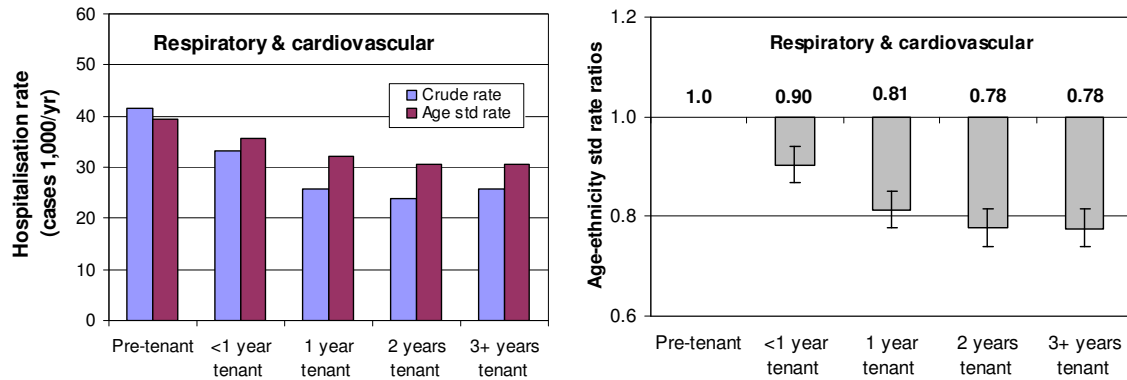


#### 6.2.5. Circulatory and respiratory disease hospitalisations

Figure 6.11 shows circulatory and respiratory disease hospitalisations in the cohort population. Rates decreased 10% after pre-tenant applicants moved to HNHC houses (RR=0.90), then the rate decreased during the tenancy in the first year (RR=0.81) and

second years (RR=0.78) as tenants. Rate ratio plateau after 3+ years household tenancy (RR=0.78).

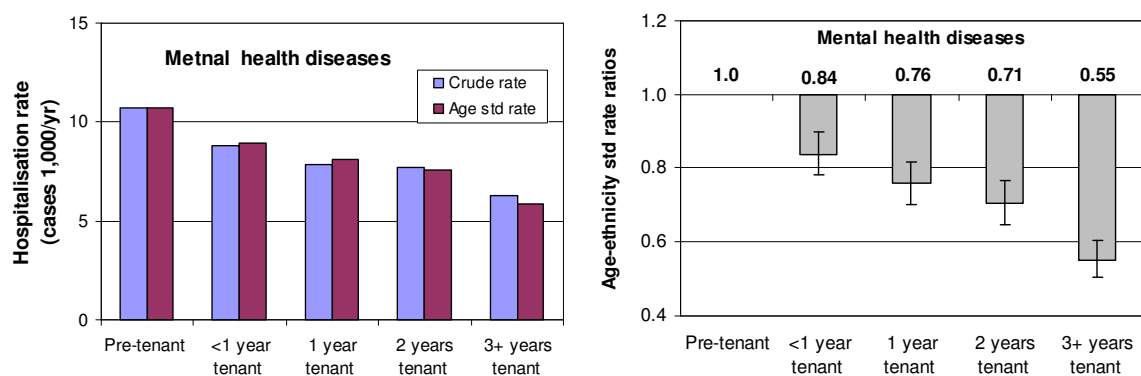
**Figure 6.11: Circulatory and respiratory disease hospitalisation rates and rate ratios for pre-tenant applicants and tenants of varying durations (based on household)**



### 6.2.6. Mental and behavioural disorder hospitalisations

Mental and behavioural disorder hospitalisations decreased significantly with tenancy duration, as shown in Figure 6.12. The rate decreased 16.3% during tenancy periods of less than one year, 24.2% in the first year, 29.4% in the second year, and up to 44.9% in the 3+ years period.

**Figure 6.12: Mental and behavioural disorder hospitalisation rate and rate ratios for pre-tenant applicants and tenants of varying durations (based on household)**

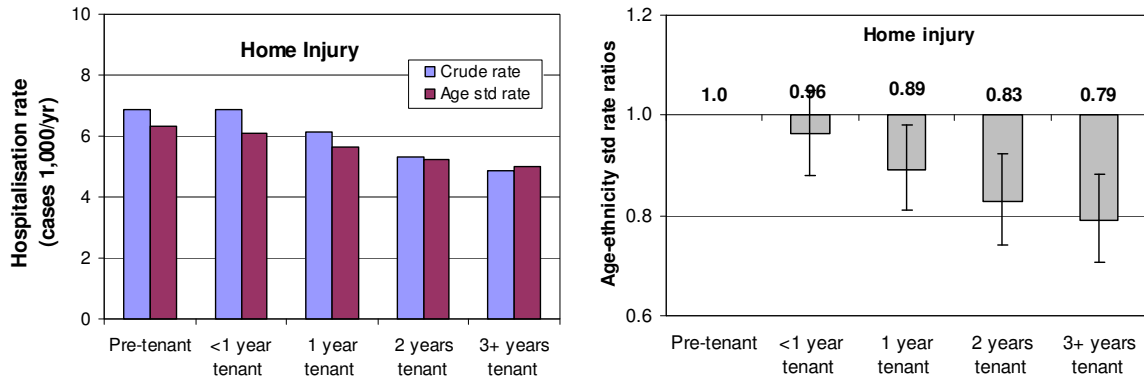


### 6.2.7. Home injury hospitalisations

Hospitalisations for home injury (Figure 6.13) had a non-significant decline after pre-tenant applicants moved to HNZN houses (RR=0.96). This decline became significant during the

first year (RR=0.89), and continued to decline during the second year (RR=0.83) and 3+ years (RR=0.79) as tenants.

**Figure 6.13: Home injury hospitalisation rates and rate ratios for pre-tenant applicants and tenants of varying durations (based on household)**



### 6.3. Hospitalisation rates for non-housing conditions

The analyses have been repeated for two conditions that are less likely to be related to housing conditions.

- Non-home injuries
- Neoplasms (cancers).

#### 6.3.1. Non-home injury hospitalisations

Figure 6.14 shows hospitalisations for non-home injury. These rates decreased significantly after pre-tenant applicants moved to HNZN houses. The age-ethnicity rate ratios of pre-tenant applicants were 0.85 for less than 1 year, 0.75 for the first year, 0.78 for the second year and 0.73 for 3+ years as tenants.

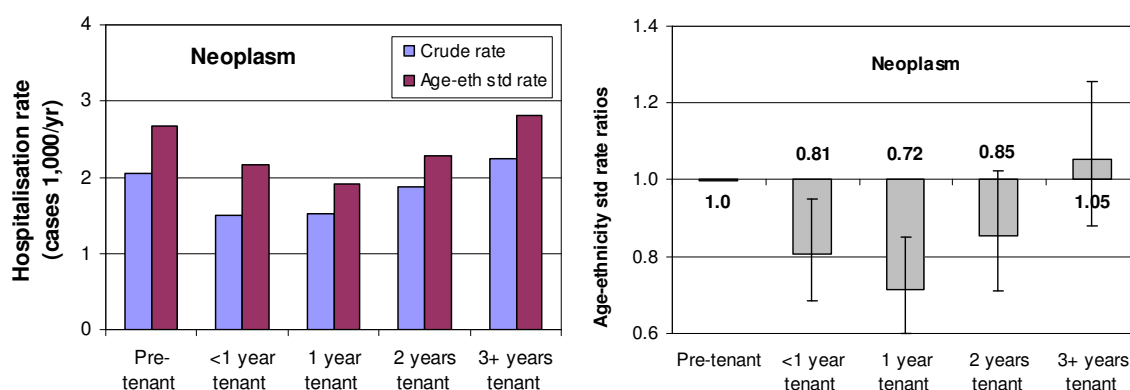
**Figure 6.14: Non-home injury hospitalisation rates and rate ratios for pre-tenant applicants and tenants of varying durations (based on household)**



### 6.3.2. Neoplasm hospitalisations

Figure 6.15 shows hospitalisations for neoplasms. These rates decreased during the first two years after pre-tenant applicants moved to HNHC housing, and then showed a rising trend with increasing duration as a tenant. The age-ethnicity rate ratios of pre-tenant applicants were 19.3% lower for less than 1 year, 28.5% lower in the first year, 14.7% lower for the second year, and 5.2% higher for 3+ years as tenants.

**Figure 6.15: Neoplasm hospitalisation rates and rate ratios for pre-tenant applicants and tenants of varying durations (based on household)**



## 6.4. Hospitalisation rates for young children and elderly

This section specifically examines hospitalisations for two sub-populations of HNHC tenants: young children (<5 years) and the elderly (65+ years). These groups are important as they have relatively high hospitalisations rates and may be particularly vulnerable to the health effects of poor housing. However, their inclusion in the cohort population may be problematic. Newborn children may not be recorded as tenants on the IRR form. And small

numbers of elderly people may experience very high levels of hospitalisation, before exiting HNZC properties, caused by severe progressive illness prior to death. Both groups also experience marked changes in their hospitalisation rates over time caused by aging: for children this results in the steady decline in hospitalisation rates, for the elderly this results in the progressive increase in hospitalisation. Both changes are independent of housing effects so could confound observed changes in hospitalisation rates following allocation to social housing (although this effect could be largely controlled by age-standardisation which is routinely carried out).

Table 6.1 shows the number of HNZC pre-tenant applicants and tenants who are children and elderly. It confirms the relatively large number of children less than 5 years in the pre-tenant applicant population (16,290) and the small number of elderly (2,252).

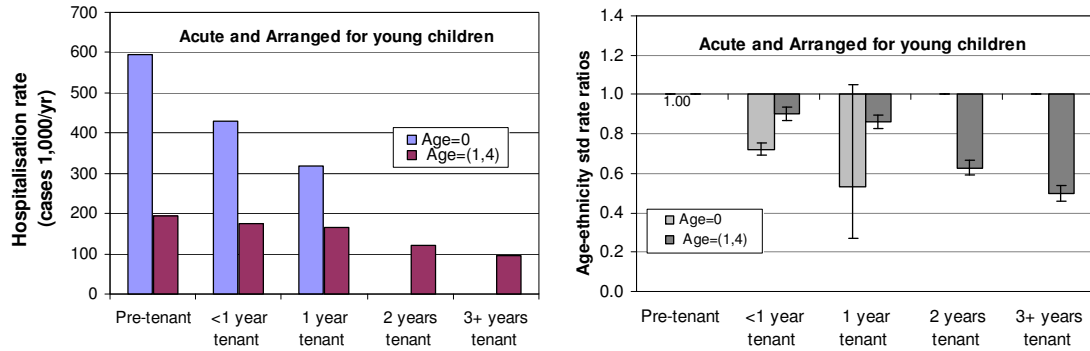
These results also show that the child population recorded as tenants declines markedly with tenancy duration. After one year, there are almost no infants recorded as tenants. The population recorded as children 1-4 years also drops steadily after one year. This pattern contrasts with the elderly where numbers also decline, but to a far lesser extent.

**Table 6.1: Children and elderly in the pre-tenant applicant population and tenants populations of varying durations, numbers and person-time**

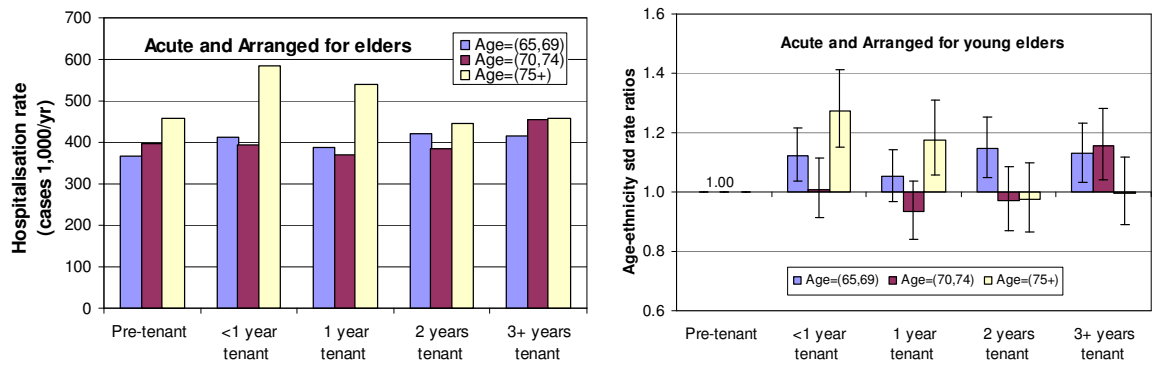
Age group	Pre-tenants		Tenants <1 year		Tenants 1 year		Tenants 2 years		Tenants 3+ years	
	No.	Person time (years)	No.	Person time (years)	No.	Person time (years)	No.	Person time (years)	No.	Person time (years)
< 1 year	4,910	1,975.8	3,619	2,717.0	11	5.2	4	2.8	3	2.4
1- 4 years	11,380	5,563.1	13,050	9,865.4	9,074	7,324.5	4,766	3,577.0	1,891	1,663.5
65- 69 years	1,087	691.2	1,160	918.1	976	755.3	746	559.2	532	584.9
70 - 74 years	663	384.5	733	580.1	656	498.9	497	373.8	404	396.2
75+ years	502	266.3	574	467.4	521	409.2	407	313.9	321	361.5

Figure 6.16 shows hospitalisation rates for young children dropped significantly with tenancy durations. The rates for infants declined 27.8% as people moved from being pre-tenant applicants to tenants<1 year, 36.6% for tenants in 1 year. The numbers of infants remaining in the cohort was too small to calculate rates after that. Hospitalisation rates for children 1 to 4 years declined 9.9% after pre-tenant applicants became tenants for <1 year, 14.1% for tenants after 1 year, 47.2% for tenants after 2 years, and 50.1% for tenants after 3+ years. Figure 6.17 shows hospitalisation rates for elderly tenants over time. In general, rates increased over time, but tended to be unstable because of the small numbers in this age group.

**Figure 6.16: Acute and arranged hospitalisation rates and rate ratios for pre-tenant applicants and tenants of varying durations (based on household), children 0-4 years**



**Figure 6.17: Acute and arranged hospitalisation rates and rate ratios for pre-tenant applicants and tenants of varying durations (based on household), adults 65+ years**



## **7. Hospitalisations in the comparative cohort approach**

This section of the report analyses the impact of moving from the HNZN waiting list to a house, but restricts the analysis to a cohort of HNZN tenants who have been followed from being applicants to becoming tenants. This group was compared with a cohort of people who were placed on the HNZN waiting list and who did not get allocated a house (unsuccessful applicants). The tenant population was further divided into those tenants who were allocated a house, but left this in less than 2 years (early exit tenants) and those who stayed longer (long term tenants).

Most of these analyses focus on the cohort of people aged between 5 and 65 years at cohort start time. Hospitalisations for infants and young children less than 5 years tend to decline quickly with increasing age. Hospitalisations for older people increased with their age. Although we usually present age-standardised rates, this process is not sufficient to adjust for the very large effects of age-related changes in hospitalisation at the extremes of age. A further complication is that newborn children tend not to be recorded on the IRR form, so this group rapidly ‘disappears’ from the tenant population over time. The cohort is also ethnicity-standardised to adjust for the different ethnicity structure of successful and unsuccessful tenants.

These analyses follow the cohort for 2 years after moving into the HNZN house, or for 2-years after being removed from the HNZN waiting list for those who were not allocated to a house. They also present hospitalisations rates for the 2 previous years, regardless of how long the person was on the HNZN waiting list for a house.

### **7.1. Hospitalisation rates for housing-related conditions**

This analysis has been carried out for the following disease and injury categories, which are plausibly related to housing conditions:

- Total acute and arranged hospital admissions
- Total potentially avoidable hospitalisations
- Housing-related potentially avoidable hospitalisations
- Close contact infectious diseases
- Circulatory and respiratory disease hospitalisations
- Mental and behavioural disorder hospitalisations
- Home injury hospitalisations.

Results are presented graphically in the following sections. Numerical results are tabulated in the appendix (Table 10.4).

#### **7.1.1. Total acute and arranged hospital admissions**

The total acute overnight hospitalisation rates for the cohort population of long-term tenants, early-exit tenants, and unsuccessful applicants (all during 4 years follow-up time) is shown in Figure 7.1. It includes an analysis for the cohort of those aged 5-65 years.

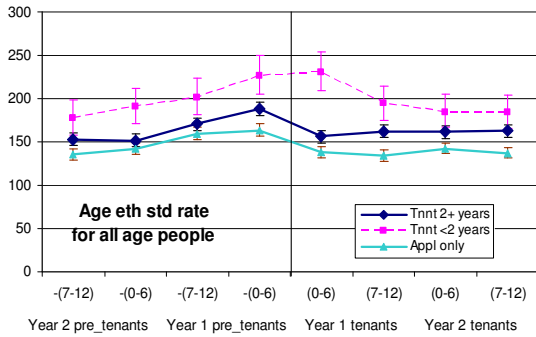
Unlike the subsequent analyses, it also presents results for a range of age bands (based on age group at cohort start time: 0 year, 1-4 years, 5-65 years and 66+ years) and for the early-exit tenants.

During 4 years follow-up (including 2 years before being housed or removed from the HNZN waiting list and 2 years after this), total acute and arranged hospitalisations for infants dropped about 75.2% and for children 1-4 years dropped about 39.8%. These declines are mainly because hospitalisations for children decrease rapidly as they age. Hospitalisations for people aged between 5 and 65 years tend to rise prior to being housed or removed from the HNZN waiting list, and then decline after this. Unsuccessful applicants had consistently lower hospitalisation rates than those who qualified for housing. Those 66+ years of age had the highest hospitalisation rates. These rates tended to rise gradually over the 4-year observation period with little apparent effect from a shift into social housing. The early-exit tenants tended to have a higher and more rapidly rising hospitalisation rate, which may reflect the fact, that some of them tend to exit because of worsening health.

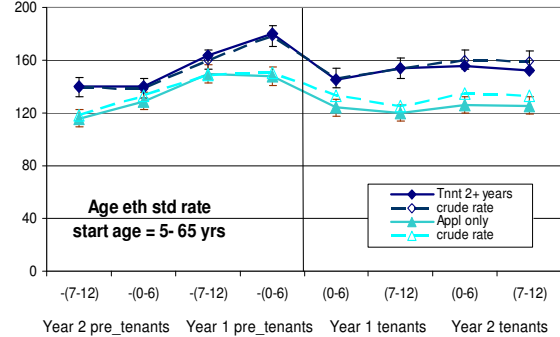
The remainder of these analyses are restricted to the cohort of tenants aged 5-65 years at the starting time of cohort. This focus avoids the confounding effects of age described above. The comparison uses long-term tenants (2+ years) compared with unsuccessful tenants (those not allocated a house) and for simplicity does not include early-exit tenants (those who exited after less than 2 years).

The rate of acute and arranged overnight hospitalisations is approximately 15% higher for those allocated to a HNZN house, compared to those not allocated to a house. This difference remains fairly consistent for the whole observation period. Both groups have increasing hospitalisation rates as applicants in the period before housing allocation (or removal from the HNZN waiting list), and both then experience a rapid decline in hospitalisations after that. Both groups appear to quickly return to rates of hospitalisation that are similar to their 'baseline' levels.

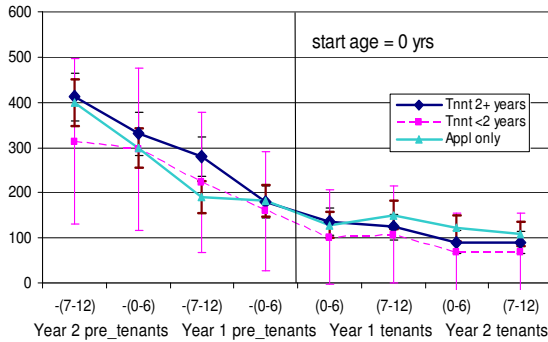
**Figure 7.1: Acute and arranged hospital admission rate cohorts of long-term tenants (2+ years), short-term tenants (2 years) and unsuccessful applicants, based on time periods in relation to tenancy start date**



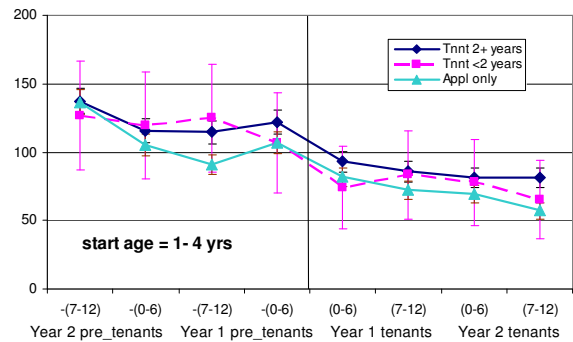
(a) All age groups - standardised



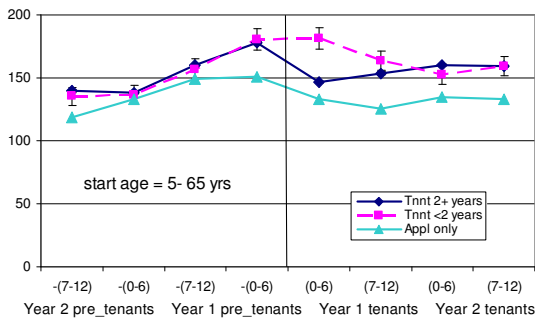
(b) Aged 5-65 at start - standardised



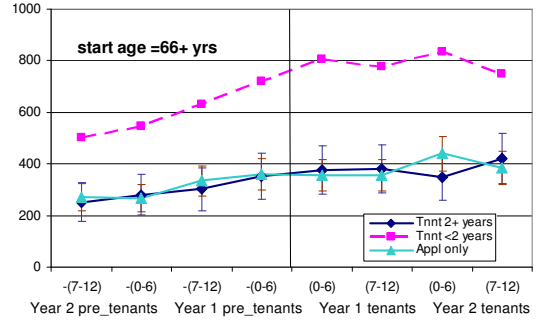
(c) Aged <1 year at start



(d) Aged 1-4 years at start



(e) Aged 5-65 years at start

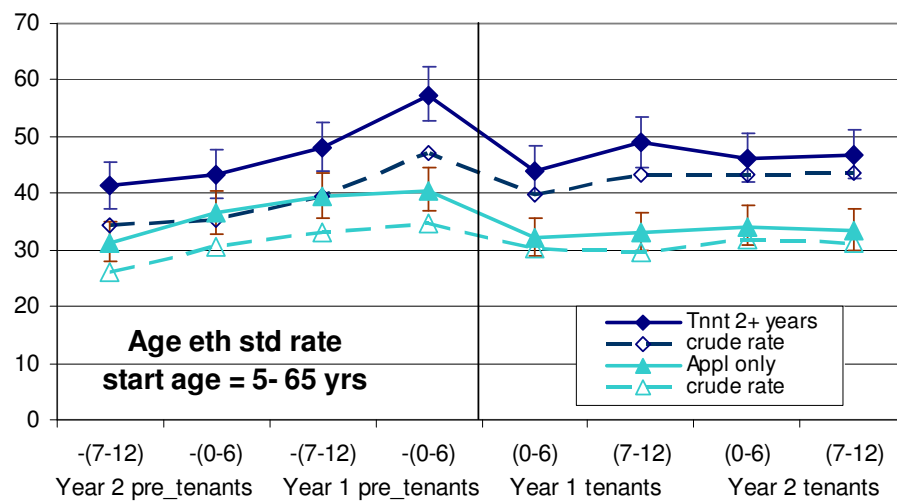


(f) Aged 66+ years at start

### 7.1.2. Total potentially avoidable hospitalisations

Potentially avoidable hospitalisations (PAH) for the cohort of people aged 5-65 years for 4-years of observation time are shown in Figure 7.2. The pattern was similar to that seen for total acute and arranged overnight hospitalisations. Hospitalisation rates were consistently higher for those allocated to a HNZC house compared to those placed on the waiting list but not allocated a house. Hospitalisation rates appeared to increase to a peak during the 6-months before becoming tenants (or being removed from the HNZC waiting list). Hospitalisation rates dropped quickly during the first 6 months after moving into HNZC houses and then returned to approximately the previous 'baseline' level.

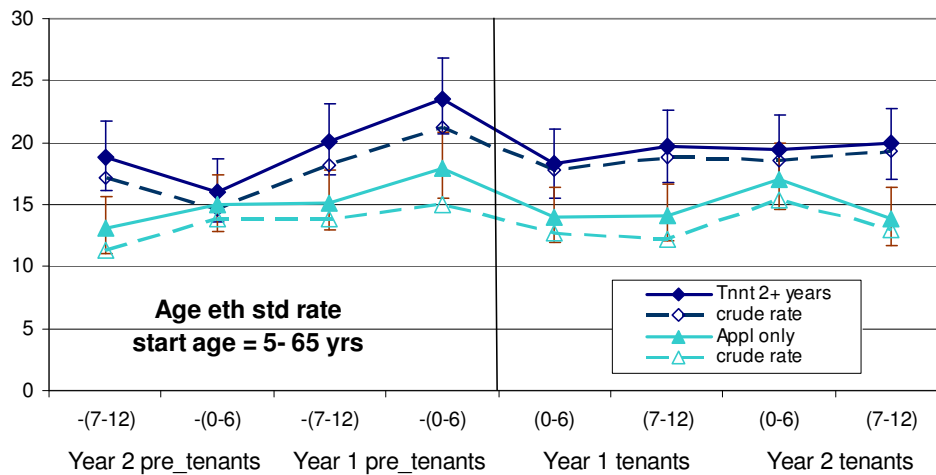
**Figure 7.2: PAH hospitalisation rates for cohorts of long-term tenants (2+ years), and unsuccessful applicants, based on time periods in relation to tenancy start date**



### 7.1.3. Housing-related potentially avoidable hospitalisations

Hospitalisations for housing-related potentially avoidable hospitalisations (HR-PAH), over a 4-year period for people 5-65 years, are shown in Figure 7.3. These rates again compare the tenant cohort with unsuccessful applicants. Results of this analysis show a similar pattern to that seen for total acute and arranged overnight admissions and for PAH.

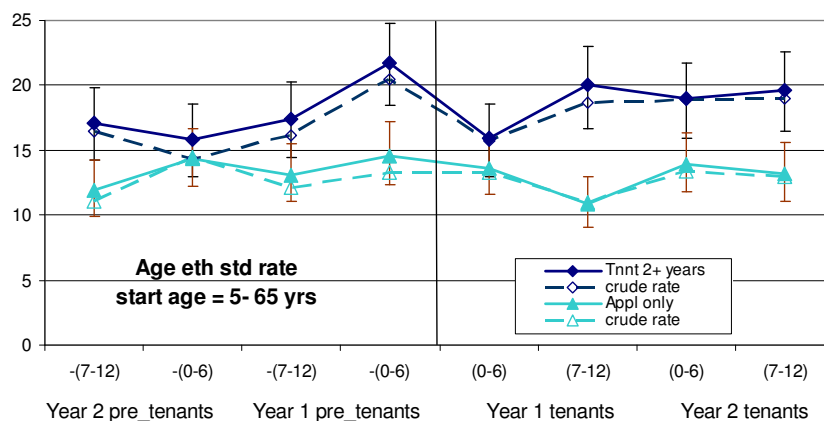
**Figure 7.3: HR-PAH hospitalisation rate for cohorts of long-term tenants (2+ years), and unsuccessful applicants, based on time periods in relation to tenancy start date**



#### 7.1.4. Close contact infectious diseases

Figure 7.4 shows the hospitalisations trends for close contact infectious diseases (CCID) over a 4-year period for people 5-65 years, again comparing the tenant cohort with unsuccessful applicants. This analysis shows a similar pattern to that seen for total acute and arranged overnight admissions, PAH, and HR-PAH.

**Figure 7.4: CCID hospital admission rates for a cohort of long-term tenants (2+ years), short-term tenants (2- years) and unsuccessful applicants, based on time periods in relation to tenancy start date**

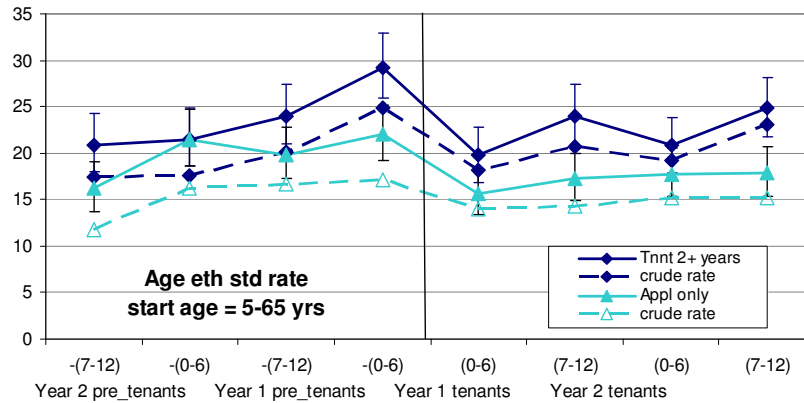


#### 7.1.5. Circulatory and respiratory disease hospitalisations

Figure 7.5 shows hospitalisations trends for circulatory and respiratory diseases over a 4-year period for people 5-65 years, again comparing the tenant cohort with unsuccessful

applicants. This analysis shows a similar pattern to that seen for total acute and arranged overnight admissions, PAH, HR-PAH, and CCID.

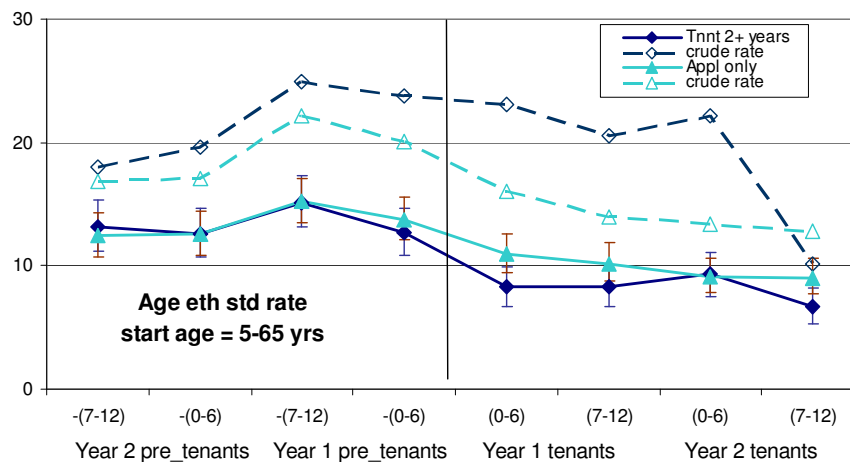
**Figure 7.5: Circulatory and respiratory hospitalisation rates for cohorts of long-term tenants (2+ years), and unsuccessful applicants, based on time periods in relation to tenancy start date**



### 7.1.6. Mental and behavioural disorder hospitalisations

Figure 7.6 shows hospitalisations for mental and behavioural disorders over a 4-year period for people 5-65 years, again comparing the tenant cohort with unsuccessful applicants. This analysis shows a different pattern to that seen for total acute and arranged overnight admissions, PAH, HR-PAH and CCID. After adjusting by age and ethnicity, tenants and unsuccessful applicants had similar hospitalisation rates. Rates for both groups declined after the reference date, tenants dropping slight faster and further.

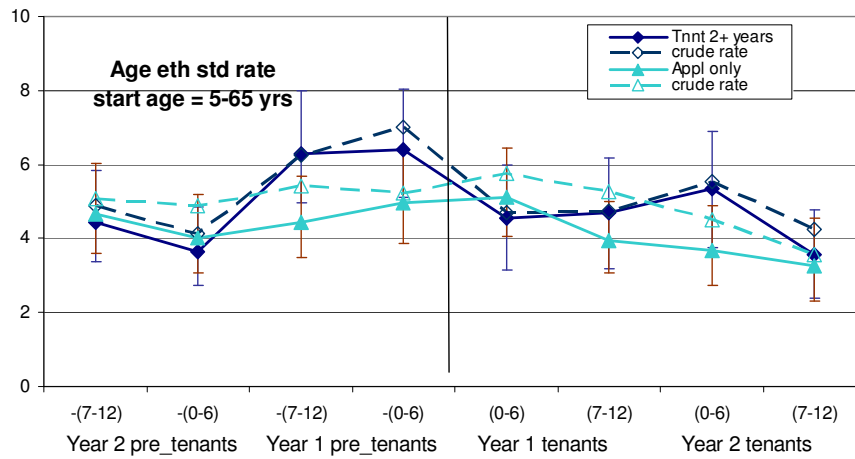
**Figure 7.6: Mental and behavioural disorder hospitalisation rates for cohorts of long-term tenants (2+ years), short-term tenants (2- years) and unsuccessful applicants, based on time periods in relation to tenancy start date**



### 7.1.7. Home injury hospitalisations

Figure 7.7 shows hospitalisations rates for home injuries over a 4-year period for people 5-65 years, again comparing the tenant cohort with unsuccessful applicants. The hospitalisation rates for the tenant cohort were not stable because of small numbers, but generally showed a similar pattern to total acute and arranged overnight admissions, PAH, HR-PAH and CCID.

**Figure 7.7: Home injury hospitalisation rate for cohorts of long-term tenants (2+ years), short-term tenants (2- years) and unsuccessful applicants, based on time periods in relation to tenancy start date**



## 7.2. Hospitalisation rates for non-housing conditions

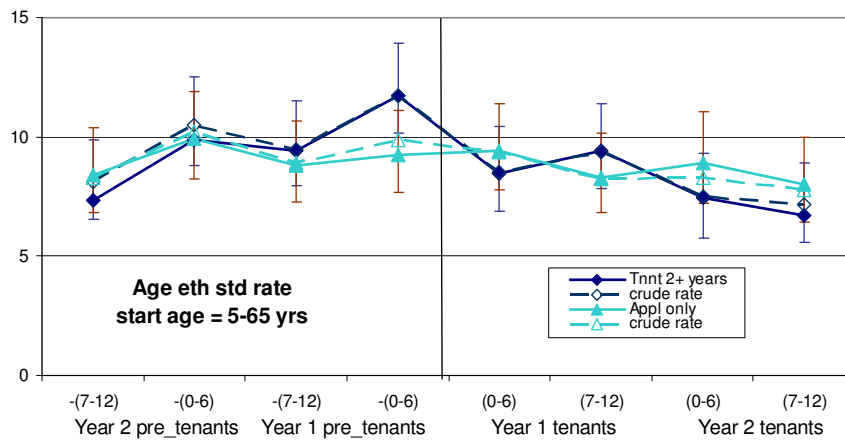
The analyses have been repeated for two conditions that are less likely to be related to housing conditions.

- Non-home injuries
- Neoplasms (cancers).

### 7.2.1. Non-home injury hospitalisations

Figure 7.8 shows hospitalisation rates for injuries that are recorded as occurring at a place other than the home. The rate of such events is elevated in applicants prior to placement and drops significantly after placement in an HNZC house. Unsuccessful applicants also experience a drop in hospitalisations, though this is less marked.

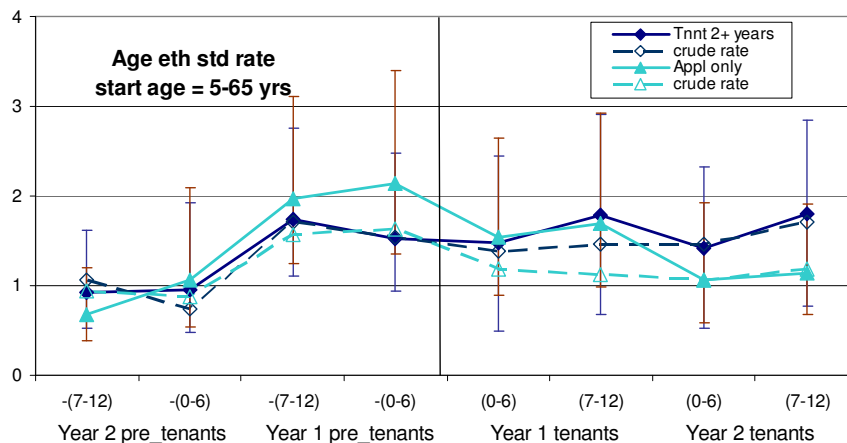
**Figure 7.8: Non-home injury hospitalisation rates for cohorts of long-term tenants (2+ years), short-term tenants (2- years) and unsuccessful applicants, based on time periods in relation to tenancy start date**



### 7.2.2. Neoplasms (C00-D48)

Hospitalisations for neoplasms (cancers) were uncommon. The rate for successful applicants didn't change when they moved to HNHC houses and increased with time. However the rate for unsuccessful applicants declined with time.

**Figure 7.9: Neoplasm hospitalisation rates for cohorts of long-term tenants (2+ years), short-term tenants (2- years) and unsuccessful applicants, based on time periods in relation to tenancy start date**



## **8. Discussion**

### **8.1. Key findings**

This study confirmed previous observations that placement in an HNZN house is associated with a significantly lower rate of hospitalisation for a range of health outcomes. The association of lower hospitalisation rates with longer duration of tenancy suggests that stable housing may contribute to substantial health improvements.

However, the cohort analysis did not generally find a prolonged protective effect from allocation to HNZN housing. The improvement in health status appears to be, at least in part, a consequence of a temporary period of worse health for this population while they are on the HNZN waiting list. When followed as a cohort, their acute hospitalisation rate dropped to a significantly lower rate within their first 6-months as a tenant. But this rate was similar to their previous 'baseline' observed retrospectively.

Additionally, the experience of long-term tenants (those who apply for a house and remain in it for 2+ years) appears similar to that seen for unsuccessful housing applicants. Both groups show a short-term decline in hospitalisations following allocation to a HNZN house or removal from the HNZN waiting list in the case of unsuccessful applicants. Both groups also subsequently return to approximately their baseline levels of hospitalisation. This pattern was apparent for most health measures used, notably: total acute and arranged hospital admissions; PAH; HR-PAH; CCID; circulatory and respiratory disease hospitalisations; and home injury hospitalisations.

Exceptions to this pattern were seen for mental and behavioural disorder admissions, which declined markedly following placement in a HNZN house and remained at this new lower rate for the 2-years of follow-up. Injuries outside the home also declined markedly and maintained this lower rate

### **8.2. Conclusions and implications**

HNZN applicants are a vulnerable group with high rates of hospitalisation and deteriorating health status leading up to the period when they apply for a house. Placement in a house is associated with marked improvements in health, as measured by declined hospitalisation for a wide range of conditions.

Findings from this study suggest that some of the improvement in health observed for HNZN tenants appears to be caused by 'regression to the mean'. With this phenomenon, those with relatively poor health status would, at least partially, improve over time with or without a change in housing. Placement in social housing may accelerate this return to improved health, but this possibility still needs further investigation.

These data suggest that social housing produces a sustained improvement in health over moderate to longer periods for some conditions. Hospitalisation rates for mental and behavioural disorders and some types of injury declined markedly following placement in social housing and these declines were sustained for the 2-year follow-up period. These declines were marginally more pronounced for long-term tenants than those seen for

unsuccessful applicants. Total acute and arranged admissions however tended to rise for tenants compared with unsuccessful applicants.

There is still little published evidence on the health effects of housing improvements [28]. We are not aware of any controlled trials of the health effects of social housing. A related area where trials have been carried out is medical priority re-housing (MPR) for applicants with medical or care needs. Three studies identified in this area all found improvements in self reported health, however all were small and none controlled for the effect of potential confounders [28]. The one study that used health service utilisation rather than self-reported health status found no clear effect [29]. There is also evidence for highly marginalised groups, such as injecting drug users, that their reported utilisation of hospital services decreases when they have stable housing [30].

There are plausible mechanisms by which social housing could contribute to health improvement. Not only does it provide secure and reasonably adequate housing, there is also usually an increase in disposable income from the associated housing subsidy (termed “Income Related Rent” in New Zealand). Such subsidies may have an independent positive effect on health [31].

Findings from this study provide support for HNZC’s social allocation formula. Those prioritised to receive social housing appear to have consistently higher health needs than those who are not allocated to such housing.

### **8.3. Limitations**

This present study has several limitations.

- It is restricted to those tenants who qualify for an income related rent (IRR) and complete an IRR application form each year. These households include 92.3% of tenancies (61,220 out of 66,315 HNZC tenancies in December 2009).
- Hospitalisations will only measure a proportion of diseases cases. The exclusion of some categories of hospitalisations (such as those containing most elective surgical cases) reduces the range of hospitalisations events included.
- Accurately assigning participants and their person-time to the study is prone to some error. Some of these errors reflect the limitations of using administrative data, which are collected for applicant and tenant management purposes. However, none of these limitations are likely to have been of sufficient importance to alter the major findings of this research.
- The tenancy duration analysis is limited by a systematic gap in the recording of infants on the IRR form. The analysis here has shown that virtually no newborn infants in tenant households are recorded on RENTEL. Consequently, it is not possible to assess the impact of HNZC housing on the health of young children.
- The cohort analysis used a restricted age group (5-65 years) so that it could follow the same individuals over time. Because we wished to gain an indication of ‘baseline’ hospitalisation rates for a period before most people were assessed for social housing, we began the cohort two years before allocation to a HNZC house or removal from the HNZC waiting list in the case of unsuccessful applicants. Consequently, the minimum possible age of tenants was two years. Because young children have particularly high hospitalisation rates, the aging of the cohort will automatically mean a decline in

hospitalisation rates over time. We therefore set the minimum age at the start of the cohort period at 5 years. Older age groups (66+) also have higher hospitalisation rates that, unlike children, tend to increase as the cohort ages. This population is also a relatively small proportion of HNZC applicants and tenants (3.3%). Again, we excluded them from the cohort analysis to help ensure that changes in hospitalisation rates were providing a valid indication of the health effects of HNZC housing. However, infants and children have the highest rates of hospitalisation and may be particularly vulnerable to poor housing conditions. As a result, this restriction reduces study power and generalisability. A specific analysis of hospitalisations rates by age group suggests that HNZC housing is associated with a particularly marked decline in hospitalisations for children with increasing duration of time in a house (but not for those 66+ years).

- Another potential source of error in the comparative cohort study is that hospitalisation rates calculations for the period before the Needs Assessment assume that the person was living in New Zealand and eligible to become a case. A proportion of HNZC applicants would be newly arrived in New Zealand so could not contribute to rates. This would have the effect of decreasing the calculated hospitalisation rate during the baseline period and therefore reducing any apparent effect from a HNZC house. Removing people who have died from the cohort analysis also raises problems. This process uses mortality data so has a 2-year lag.
- Drawing causal inferences from these findings remains problematic, as has been found in studies exploring the health effects of homelessness [32]. This analysis of hospitalisation data uses age-ethnicity-standardised rates. However, there are other confounders that have not yet been considered in the analysis (e.g. changes in household income and tobacco smoke exposure).
- This cohort analysis is not a controlled trial where a careful randomisation process decides those receiving the intervention or not receiving it. Instead, the allocation is deliberately non-random and based on a highly developed social allocation system. Consequently, we cannot draw firm conclusions about the impact of social housing on those who received it by comparing them with those who did not.
- Similarly, we need to be cautious in conclusions we draw from observing changes in hospitalisation rates in tenants over time. There is considerable potential for ‘cohort effects’ caused by changes in the wider social, economic and health environment in New Zealand that may have taken place while the cohort has been operating. Changes in employment levels, the cost of living, and other external factors could alter hospitalisation rates over time independent of the effects of housing conditions.

#### **8.4. Further research work**

It would be useful to repeat this analysis with further years of cohort data to improve the precision of the findings.

We will also consider how we can strengthen the causal inferences which can be drawn from the observed associations between HNZC tenancy and lower hospitalisation rates. Several epidemiological methods have been developed to strengthen the use of observational epidemiological data allowing it to better approximate an experimental study:

- Propensity scores – These provide a way of adjusting for differences in the characteristics of an intervention group (those with social housing) and control groups (those not allocated such housing and those that have left such housing). This approach has been applied to such areas as assessing the effects of residential segregation on health outcomes [33]. Even without using this approach, we could use the household priority ratings applied by HNZC as a way of improving the comparability of the successful and unsuccessful housing groups. Although successful applicants generally have a higher proportion of priority A and B households than unsuccessful applicants, there is still considerable overlap in these groups (Table 4.4).
- Instrumental variables - These provide a method that can potentially overcome the selection biases inherent in observational data and give more valid estimates of the effects of social housing. This approach has been applied to measuring the health benefit of public housing in the US [34]. Finding a suitable instrumental variable to use would be challenging and this method may not be useful for this current study.
- Multivariate regression – Poisson regression could be used to control for multiple co-variates that might also influence hospitalisation rates. We could investigate controlling for personal underlying health status (perhaps using previous hospitalisation records to provide an indication of underlying healthy status).

These approaches could be used to reduce the selection bias that occurs when housing applicants with certain characteristics are prioritised to receive social housing, and that may occur over time when those with certain characteristics are more or less likely to remain in social housing. These methods could then be applied to assessing whether the observed improvement in hospitalisation over time was caused by regression to the mean, or was likely to be an effect of social housing.

To improve the quality of housing tenant data, HNZC could consider approaches to encourage tenants completing an IRR application to record details of all people in their households, including all newborn children and other additions to their households. The analyses in his report show that virtually no children born into tenant households are being recorded on the IRR application and entered into RENTEL.

A further potential improvement would be to introduce systematic measurement of housing quality. This present analysis is treating the move into social housing as a ‘black box’. This move represents a set of changes, including for example a change in the physical nature of the house, possibly a significant change in neighbourhood, an increase in security of tenure, and sometimes a reduction in housing rental. It would be useful to quantify these changes in ‘exposures’ more exactly. One component that could be measured would be housing quality. He Kainga Oranga has developed a comprehensive Healthy Housing Index assessment tool, which has now been used and validated on more than 1,000 New Zealand houses. It is also comparable to the BRANZ national House Conditions Survey. There could be considerable value in using the HHI to measure the quality of HNZC housing so that the impact of house conditions on health could be measured.

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## 10. Appendix

### 10.1. Summary of indicators

Indicator	ICD.10 codes	Age group
Hospitalisations – Total, Avoidable & Housing related	See appendix 10.2	All
Total acute and arranged hospital admissions	A00-N99, R00-T98	All
Potentially avoidable hospitalisations – Ambulatory sensitive	See appendix 10.2	All
Potentially avoidable hospitalisations – Population preventable	See appendix 10.2	All
Potentially avoidable hospitalisations – Housing related	See appendix 10.2	All
<b>Mortality</b>	-	-
Total mortality		All
<b>Infectious diseases</b>	-	-
Close contact infectious diseases	See appendix 10.3	All
Gastroenteritis	See ICD.10 codes in appendix 10.3	Child <18 years
Meningitis & septicaemia	See ICD.10 codes in appendix 10.3	Child <18 years
Influenza and Pneumonia	J10-J18	All
Bronchiolitis	J21	Child <5year
Skin infections	See ICD.10 codes in appendix 10.3	All
<b>Respiratory and cardiovascular diseases</b>	-	-
Circulatory and respiratory disease hospitalisations	I00-I99, J00-J99	All
Excess winter hospitalisations (circulatory & respiratory)	I00-I99, J00-J99	All
Excess winter mortality (circulatory & respiratory)	I00-I99, J00-J99	All
Asthma	J45, J46	All
Chronic Obstructive Pulmonary Diseases	J40-J44	Adults>17years
Ischaemic heart disease	I20-I25	Adults>17years
Heart Failure	I50	Adults>17years
<b>Mental health conditions</b>	-	-
Mental health hospitalisations	F00-F99	All
Depressive episode	F32	Adults>17years
Psychosis	F20-F29	Adults>17years
Intentional self harm	S00-T99 + E-code for intentional self harm (X60-X84)*	All
Assault in the home	S00-T99 + E-code for assault (X85-Y09)*	All
<b>Home injuries</b>	-	-
Home injury hospitalisations	S00-T99 *	All
Falls at home	S00-T99 + E-code for fall (W00-W19)*	All
Accidental poisonings at home	S00-T99 + E-code for accidental poisoning (X40-X49)*	Child <5 years
Injury from exposure to smoke and flames and home	S00-T99 + E-code for exposure to smoke, fire and flames (X00-X09)*	All
Burns and scalds at home	S00-T99 + E-code for exposure to heat and hot substances (X10-X19)*	All

\*Occurrence at home identified by additional code (4th digital is 0 in ICD.10 v1, or Y920 in ICD.10 V2&3).

## ***Potentially avoidable hospitalisations and mortality***

### **Potentially avoidable hospitalisations (including ASH and PPH)**

**Current list supplied by Ministry of Health, August 2008 (with additional column added for HR-PAH)**

<b>Condition</b>	<b>Principal Diagnosis Codes</b>	<b>Age if limited</b>	<b>PPH Weight</b>	<b>ASH Weight</b>	<b>HR-PAH<sup>1</sup></b>
Alcohol related conditions	F10, I426, K290, K70	A	1	0	
Angina and chest pain	I20, R072-R074	A	0.5	0.5	
Asthma	J45-J46		0	1	1
Bronchiectasis	J47	C	0	1	
Cellulitis	H000, H010, J340, L01-L04, L08, L980		0	1	1
Cervical cancer	C53	A	0	1	
Congestive heart failure	I50, J81	A	0	1	
Constipation	K590		0	1	
CORD	J40-J44, J47	A	1	0	1
Dental conditions	K02, K04, K05		0	1	
Dermatitis & eczema	L20-L30		0	1	
Diabetes	E10-E14, E162	A	0	1	
Epilepsy	G40-G41, O15, R560, R568	A	0	1	
Gastroenteritis/dehydration	A02-A09, R11		0	1	1
GORD (Gastro-oesophageal reflux disease)	K21		0	1	
HIV AIDS	B20-B24		1	0	
Hypertensive disease	I10-I15, I674	A	0	1	
Kidney/urinary infection	N10, N12, N136, N309, N390	A	0	1	
Lung cancer	C33-C34	A	1	0	
Myocardial infarction	I21-I23;I241	A	0.5	0.5	
Non-B Hepatitis and liver cancer	B15,B17-B19, C220, C221, C229, P353	A	1	0	
Nutrition Deficiency and Anaemia	D50-D53, E40-E46, E50-E64, M833*		0	1	
Obstructed hernia	K400, K401, K403, K404, K410, K411, K413, K414, K420, K421, K430, K431, K440, K441, K450, K451, K460, K461		1	0	

Oral cancers	C01-C06, C09, C10	A	1	0	
Other ischaemic heart disease	I240, I248, I249, I25	A	0.5	0.5	
Pelvic inflammatory disease	N70-N77	A	1	0	
Peptic ulcer	K25-K28	A	0	1	
Respiratory infections - Acute bronchiolitis	J21	C	0	1	1
Respiratory Infections - influenza, viral pneumonia, acute bronchitis	J10-J12, J20		1	0	1
Respiratory infections - Pneumonia	J13-J16, J18		0	1	1
Rheumatic fever/heart disease	I00-I02, I05-I09		0	1	
Ruptured appendix	K350, K351	A	1	0	
Sexually transmitted Infections	A50-A59, A60, A63, A64, I980, M023, M031, M730, M731, N290, N341		0	1	
Stroke	I61, I63-I66	A	0.5	0.5	
Tuberculosis	A150-A199, B900-B909, M011, P370		1	0	1
Upper respiratory tract and ENT infections, Sinusitis, Tonsillitis	J00-J04, J06, H65-H67, J01-J03, J00-J03, J040, J06		0	1	1
Vaccine-preventable disease - Hib, Meningitis, Meningococcal disease, Whooping Cough, Hep B, Pneumococcal disease, Other	A33-A37, A403, A80, B16, B18	6mth+	0	1	1 <sup>2</sup>
Vaccine-preventable disease - MMR	B05, B06, B26, M014, P350	15 mth+	0	1	

<sup>1</sup> Housing related PAH (HR-PAH) – Subset of PAH that are also included on the list of housing sensitive health outcomes.

<sup>2</sup> Only meningococcal disease (A39) in this category is included in the HR-PAH.

## 10.2. Close-contact infectious diseases

Close contact infectious diseases (CCID)	CCID to include in indicator*	ICD10 code
<b>1 Close contact enteric infections</b>		
<b>1.1 Gastroenteritis (from human sources)</b>		
Shigellosis	1	A03
Giardiasis	1	A071
Rotavirus enteritis	1	A080
Norovirus gastroenteritis	1	A081
Adenovirus enteritis	1	A082
Other viral enteritis	1	A083
Viral intestinal infection, unspecified	1	A084
Other specified intestinal infections	1	A085
Diarrhoea of presumed infectious origin	1	A09
Nausea and vomiting	1	R11
<b>1.2 Other enteric infections (from human sources)</b>		
Acute poliomyelitis	1	A80
Enteroviral encephalitis	1	A850
Enteroviral meningitis	1	A870
Acute hepatitis A	1	B15
Epidemic myalgia (Bornholm disease)	1	B330
Enterovirus infection, unspec	1	B341
Enterobiasis (pinworm)	1	B80
<b>1.3 Late effects of enteric infections</b>		
Sequelae of Poliomyelitis		B91
Osteopathy after poliomyelitis		M896
Malignant neoplasm of stomach & carcinoma in situ of stomach		C16, D002
Peptic ulcer		K25-K28
<b>2 Close contact infectious disease with respiratory transmission</b>		
<b>2.1 Tuberculosis</b>		
Tuberculosis (respiratory, CNS, other organs, miliary)	1	A15-A19
Tuberculosis of cervix, causing PID	1	N740, N741
Pneumoconiosis associated with TB	1	J65
Tuberculous oesophagitis	1	K230
Tuberculous arthritis	1	M011
Tuberculosis complicating pregnancy, childbirth and puerperium	1	O980
Observation for suspected tuberculosis	1	Z030
Tuberculosis disorders of intestines, peritoneum and mesenteric glands	1	K930
<b>2.2 Pertussis</b>		
Whooping cough	1	A37
<b>2.3 Bacterial meningitis &amp; septicaemia</b>		
Meningococcal disease	1	A39
Meningococcal arthritis	1	M010
Septicaemia due to <i>Streptococcus pneumoniae</i>	1	A403

Pneumococcal meningitis	1	G001
Pneumococcal arthritis and polyarthritis	1	M001
<i>Haemophilus influenzae</i> septicaemia	1	A413
<i>Haemophilus influenzae</i> infection unspec	1	A492
Haemophilus meningitis	1	G000
<b>2.4 Respiratory viruses</b>		
Varicella	1	B010, B011, B012, B019
Measles	1	B05
Rubella	1	B06
Rubella arthritis	1	M014
Exanthema subitum (sixth disease)	1	B082
Erythema infectiosum (fifths disease)	1	B083
Hand foot and mouth / enteroviral vesicular stomatitis with exanthem	1	B084
Enteroviral vesicular pharyngitis Herpangina	1	B085
Other viral exanthemata with skin and mucous membrane lesions	1	B088, B09
Mumps	1	B26
Coronavirus infection, unspec	1	B342
Parvovirus infection, unspec	1	B343
<b>2.5 URTI</b>		
Suppurative otitis media	1	H660, H661, H662, H663, H664
Mastoiditis	1	H700, H701, H702, H708
Acute myringitis	1	H730
Acute nasopharyngitis	1	J00
Acute sinusitis	1	J01
Acute streptococcal pharyngitis	1	J020, J030
Acute pharyngitis	1	J028, J029
Acute tonsillitis	1	J038, J039,
Acute laryngitis and tracheitis	1	J04
Acute obstructive laryngitis (croup) and epiglottitis	1	J05
Acute upper respiratory infections of multiple and unspecified sites	1	J06
Chronic sinusitis	1	J32
Peritonsillar abscess	1	J36
Retro/pharyngeal abscesses	1	J390, J391
<b>2.6 LRTI</b>		
Influenza	1	J10, J11
Viral pneumonia not elsewhere classified	1	J12
Pneumonia due to <i>Streptococcus pneumoniae</i>	1	J13
Pneumonia due to <i>Haemophilus influenzae</i>	1	J14
Pneumonia due to other organisms not elsewhere classified	1	J16
Pneumonia organism unspecified	1	J18
Acute bronchitis	1	J20
Acute bronchiolitis	1	J21
Unspecified acute lower respiratory infection	1	J22
Infective exacerbation of COPD	1	J440

Abscess of lung and mediastinum, pyothorax	1	J85, J86
<b>2.7 Post-streptococcal diseases</b>		
Rheumatic fever	1	I00, I01, I02
Acute nephritic syndrome	1	N003, N004
<b>2.8 Late effects of respiratory infections</b>		
Zoster		B02
Sequelae of Tuberculosis		B90
Malignant neoplasm of the nasopharynx		C11
Kaposi's sarcoma		C46
Hodgkin's lymphoma		C81
Burkitt's tumour		C837
Chronic rheumatic heart disease		I05, I06, I07, I08, I09
Bronchiectasis		J47
Nephrotic Syndrome - diffuse mesangial proliferative		N043
Nephrotic Syndrome - diffuse endocapillary proliferative		N044
<b>3 Close contact skin infections</b>		
<b>3.1 Bacterial skin infections</b>	1	
Impetigo	1	L01
Cutaneous abscess, furuncle and carbuncle	1	L02
Cellulitis	1	L03
Acute lymphadenitis	1	L04
Pilonidal cyst with abscess	1	L050
Other local infections of skin	1	L08
Erysipelas	1	A46
Hordeolum (abscess, sty) )	1	H000
Acute inflammation of orbit (incl. abscess, cellulitis)	1	H050
Abscess and cellulitis of external ear	1	H600, H601
Otitis externa	1	H602, H603, H608, H609
Abscess, furuncle and carbuncle of nose	1	J340
Other inflammatory disorders of penis	1	N482
Inflammatory disorder of scrotum	1	N492
Inflammatory disorder of unspecified male genital organ	1	N499
Anal abscess	1	K610
Abscess of vulva	1	N764
Varicella with other complications (infection)	1	B018
Scabies	1	B86
Other dermatitis (Infective dermatitis)	1	L303, L308, L309
Insect/spider bite	1	S1013, S1083, S1093, S2013, S2033, S2043, S2083, S3083, S3093, S4083, S5083, S6083, S7083, S8083, S9083, T009, T0903, T1108, T1303, T1403,

		T633, T634
Post- traumatic wound infection NEC	1	T793
Open wound with foreign body (with or without infection)	1	T8901
Open wound with infection	1	T8902
<b>3.2 Invasive staphylococcal infections</b>		
<i>Staphylococcus aureus</i> septicaemia	1	A410
Staphylococcal septicaemia	1	A411, A412
Staphylococcal meningitis	1	G003
Staphylococcal arthritis & polyarthritis	1	M000
Osteomyelitis	1	M86
Inflammatory disorders of breast (abscess, carbuncle, mastitis)	1	N61
Staphylococcal infection unspecified	1	A490
<b>3.3 Other skin infections from human sources</b>		
Viral warts	1	B07
Molluscum contagiosum	1	B081
Dermatophytosis (tinea)	1	B35
Other superficial mycosis	1	B36
<b>4 Close-contact disease with multiple or unknown transmission</b>		
<b>4.1 Other bacterial infections from human contact</b>		
Scarlet fever	1	A38
Septicaemia due to group A streptococcus	1	A400
Streptococcal infection unspecified	1	A491
Streptococcal meningitis	1	G002
Other Streptococcal arthritis & polyarthritis	1	M002
Pyogenic arthritis due to other bacteria & unspecified	1	M008, M009
Other bacterial meningitis	1	G008, G009,
Non pyogenic meningitis (non bacterial)	1	G030
Chronic meningitis, benign recurrent meningitis (Mollaret)	1	G031, G032
Meningitis unspecified	1	G038, G039
Bacterial meningoencephalitis & meningomyelitis NEC	1	G042
<b>4.2 Other viral infections from human contact</b>		
Unspecified viral encephalitis	1	A86
Adenoviral meningitis	1	A871
Other & unspecified viral meningitis	1	A878, A879
Other & unspecific viral infections of CNS	1	A888, A89
Herpes Simplex Virus infection	1	B00
Cytomegalovirus	1	B25
Infectious Mononucleosis (gammaherpesviral mononucleosis)	1	B270
Cytomegaloviral mononucleosis	1	B271
Infectious Mononucleosis	1	B278, B279
Viral conjunctivitis	1	B30

Viral Carditis	1	B332
Adenoviral and other specified viral encephalitis	1	A851, A858
Adenovirus infection, unspec	1	B340
Papovavirus infection (incl. BKV & JCV), unspec	1	B344
Other viral infections of unspecified site	1	B348
Viral infection, unspec (incl. viremia NOS)	1	B349
<b>4.3 Other &amp; mixed infections from human contact</b>		
Conjunctivitis	1	H100, H102, H103, H104, H105, H108, H109
Pediculosis & phthiriasis	1	B85
<b>4.4 Late effects of other close-contact infectious diseases</b>		
Acute disseminated encephalitis		G040
Other encephalitis, myelitis and encephalomyelitis (postinfectious)		G048
Encephalitis, myelitis and encephalomyelitis, unspecified		G049

\*CCID indicator excludes late effects of these diseases

### **10.3. Tenants compared with pre-tenants on HNZN waiting list**

The following tables show a comparison of hospitalisations rates for housing pre-tenants compared with tenants during their first two years as tenants. These rates have been age-ethnicity standardised to adjust for differences in the age and ethnic make up of the applicant and tenant populations.

Total acute and arranged hospitalisations use ICD.10 codes for total illness and injury admissions: A00-N99, R00-T98. They exclude pregnancy, childbirth and puerperium (O00-O99), certain conditions originating in perinatal period (P00-P96), congenital malformations, deformities and chromosomal abnormalities (Q00-Q99), and factors influencing health status and contact with health services (Z00-Z99). They also exclude private hospital cases, hospital transfers, and hospital waiting list admissions, i.e. the same as the standard filter, except that day cases and readmissions within a month are retained.

Potentially Avoidable Hospitalisations (PAH) include Ambulatory Sensitive Hospitalisations (ASH) and Population Preventable Hospitalisations (PPH), and use a Ministry of Health (MOH) set of ICD.10 codes. PAH is considered a good indicator of access to primary health care services and public health programmes. HR-PAH is a subset of PAH that overlap with conditions sensitive to housing conditions. This measure therefore has the potential to provide a single indicator of the health impact of housing conditions. Filtering follows conventions used by the MoH for calculating the ASH component of PAH. Apart from the standard filter used in this report (i.e. excluding private hospital cases, overseas visitors, hospital transfers, hospital waiting list except day cases not in ED and readmissions within a month), it also filters out neonates aged <29 days and elder people aged >74 years, and restricts some diseases to cases in adults or children and excludes admissions from some primary rural facilities.

**Table 10.1: Hospitalisation rates and rate ratios (with 95% CI) for housing tenants during their household tenancy first 2 years compared with pre-tenants, according to housing sensitive health conditions, age-ethnicity standardised**

Condition	Age group	Pre-tenant rate <sup>1</sup> (ref)	<1 year tenant rate <sup>1</sup>	<1 year rate ratio (95%CI) <sup>2</sup>	<2 years tenant rate <sup>1</sup>	<2 year rate ratio (95%CI) <sup>2</sup>
<b>Hospitalisations</b>	-					
Total acute and arranged hospital admissions	All	208.6	192.5	0.92 (0.91, 0.94)	186.5	0.89 (0.88, 0.91)
Potentially avoidable hospitalisations – Ambulatory sensitive	All	54.4	50.3	0.93 (0.90, 0.95)	47.4	0.87 (0.85, 0.90)
Potentially avoidable hospitalisations – Population preventable	All	21.4	18.7	0.87 (0.82, 0.92)	18.9	0.88 (0.84, 0.93)
Potentially avoidable hospitalisations – Housing-related	All	33.8	29.6	0.88 (0.84, 0.91)	28.0	0.83 (0.80, 0.86)
<b>Infectious diseases</b>	-					
Close contact infectious diseases	All	31.7	29.3	0.92 (0.89, 0.96)	27.4	0.86 (0.83, 0.90)
Gastroenteritis	<18 years	2.9	2.8	0.97 (0.84, 1.11)	2.4	0.85 (0.75, 0.97)
Meningitis & septicaemia	<18 years	0.6	0.5	0.73 (0.51, 1.05)	0.4	0.59 (0.41, 0.83)
Influenza and Pneumonia	All	4.9	5.4	1.09 (0.99, 1.21)	4.9	1.00 (0.90, 1.09)
Bronchiolitis	<5year	37.9	20.3	0.54 (0.49, 0.58)	13.2	0.35 (0.32, 0.38)
Skin infections	All	8.5	8.5	1.00 (0.93, 1.08)	8.4	0.98 (0.92, 1.06)
<b>Respiratory and cardiovascular diseases</b>	-					
Circulatory and respiratory disease hospitalisations	All	39.4	35.6	0.90 (0.87, 0.94)	34.2	0.87 (0.84, 0.90)
Asthma	All	4.9	3.8	0.77 (0.70, 0.86)	3.9	0.79 (0.72, 0.86)
Chronic Obstructive Pulmonary Diseases	>17 years	7.0	6.4	0.91 (0.80, 1.04)	6.2	0.89 (0.79, 1.00)
Ischaemic heart disease	>17 years	6.0	6.6	1.10 (0.97, 1.25)	6.3	1.05 (0.93, 1.18)
Heart Failure	>17 years	2.6	2.9	1.12 (0.93, 1.35)	2.8	1.06 (0.89, 1.26)
<b>Mental and behavioural disorders</b>	-					
Mental and behavioural disorder hospitalisations	All	10.7	8.9	0.84 (0.78, 0.90)	8.6	0.80 (0.76, 0.86)
Depressive episode	>17 years	1.2	1.5	1.23 (0.82, 1.86)	1.1	0.88 (0.63, 1.23)
Psychosis	>17 years	4.7	4.4	0.93 (0.76, 1.09)	4.6	0.97 (0.83, 1.12)
Intentional self harm	All	2.3	2.1	0.88 (0.77, 1.02)	1.9	0.81 (0.71, 0.92)
Assault in the home	All	0.7	0.7	1.01 (0.77, 1.31)	0.7	1.03 (0.81, 1.32)
<b>Home injuries</b>	-					

<b>Condition</b>	<b>Age group</b>	<b>Pre-tenant rate<sup>1</sup> (ref)</b>	<b>&lt;1 year tenant rate<sup>1</sup></b>	<b>&lt;1 year rate ratio (95%CI)<sup>2</sup></b>	<b>&lt;2 years tenant rate<sup>1</sup></b>	<b>&lt;2 year rate ratio (95%CI)<sup>2</sup></b>
Home injury hospitalisations	All	6.3	6.1	0.96 (0.88, 1.05)	5.9	0.93 (0.86, 1.01)
Falls at home	All	1.8	1.8	0.99 (0.83, 1.18)	1.8	1.00 (0.85, 1.18)
Accidental poisonings at home	<5 years	1.0	1.3	1.30 (0.84, 1.99)	1.3	1.37 (0.91, 2.05)
Injury from exposure to smoke and flames and home	All	0.2	0.1	0.65 (0.38, 1.09)	0.1	0.47 (0.28, 0.79)
Burns and scalds at home	All	0.2	0.3	1.37 (0.98, 1.92)	0.3	1.05 (0.77, 1.44)
Injury in other specified places	All	14.5	12.3	0.85 (0.80, 0.90)	11.7	0.81 (0.76, 0.85)

<sup>1</sup>Rate: cases per 1000 per year

<sup>2</sup>This is the rate ratio for the rate in that year compared with the reference rate (ref), which in this case is the pre-tenant rate

**Table 10.2: Hospitalisation rates and rate ratios (with 95% CI) for housing tenants during their household tenancy first 2 years compared with pre-tenants, according to ICD.10 chapter of principal diagnosis, age-ethnicity standardised**

Disease / Injury chapter	Age group	Pre-tenant rate <sup>1</sup> (ref)	<1 year tenant rate <sup>1</sup>	<1 year rate ratio (95%CI) <sup>2</sup>	<2 years tenant rate <sup>1</sup>	<2 years rate ratio (95%CI) <sup>2</sup>
A00-B99 Infectious & parasitic	All	6.9	6.2	0.89 (0.82, 0.97)	5.7	0.82 (0.76, 0.88)
C00-D48 Neoplasms	All	2.7	2.2	0.81 (0.68, 0.95)	2.0	0.76 (0.66, 0.88)
D50-D89 Blood & immune system	All	1.1	0.9	0.85 (0.67, 1.07)	1.0	0.90 (0.73, 1.11)
E00-E90 Endocrine, nutritional & metabolic	All	5.2	4.7	0.91 (0.81, 1.03)	4.2	0.81 (0.73, 0.90)
F00-F99 Mental & behavioural	All	10.7	8.9	0.84 (0.87, 0.90)	8.6	0.80 (0.76, 0.86)
G00-G99 Nervous system	All	4.0	3.4	0.86 (0.76, 0.98)	3.6	0.90 (0.81, 1.01)
H00-H59 Eye & adnexa	All	0.6	0.6	0.90 (0.65, 1.25)	0.6	0.90 (0.66, 1.21)
H60-H95 Ear & mastoid	All	0.9	0.6	0.66 (0.50, 0.87)	0.6	0.74 (0.57, 0.95)
I00-I99 Circulatory system	All	13.9	13.5	0.97 (0.90, 1.05)	13.3	0.96 (0.90, 1.03)
J00-J99 Respiratory	All	25.5	22.1	0.86 (0.83, 0.91)	20.9	0.82 (0.79, 0.85)
K00-K93 Digestive	All	11.4	12.8	1.13 (1.05, 1.21)	11.8	1.04 (0.97, 1.11)
L00-L99 Skin & subcutaneous	All	8.4	8.4	0.99 (0.91, 1.07)	8.4	1.00 (0.93, 1.07)
M00-M99 Musculoskeletal & connective	All	6.1	4.8	0.78 (0.70, 0.87)	4.5	0.74 (0.67, 0.81)
N00-N99 Genitourinary	All	7.5	7.3	0.98 (0.89, 1.06)	7.2	0.96 (0.89, 1.04)
Q00-Q99 Congenital	All	0.5	0.3	0.58 (0.43, 0.78)	0.3	0.54 (0.42, 0.70)
R00-R99 Symptoms & signs	All	17.3	15.7	0.91 (0.85, 0.97)	15.3	0.88 (0.83, 0.93)
S00-T98 Injury, poisonings	All	20.8	18.4	0.88 (0.84, 0.93)	17.6	0.84 (0.81, 0.89)
Z00-Z13 Factors influencing health status	All	0.5	0.3	0.52 (0.37, 0.74)	0.2	0.45 (0.32, 0.63)

<sup>1</sup>Rate: cases per 1000 per year

<sup>2</sup>This is the rate ratio for the rate in that year compared with the reference rate (ref), which in this case is the pre-tenant rate

**Table 10.3: Hospitalisation rates and rate ratios (with 95% CI) for housing tenants of increasing household tenancy durations compared with pre-tenants, according to housing sensitive health conditions, age-ethnicity standardised**

Condition	Pre-tenant rate <sup>1</sup> (ref)	<1 year tenant rate <sup>1</sup>	<1 year rate ratio (95%CI) <sup>2</sup>	1 year tenant rate <sup>1</sup>	1 year rate ratio (95%CI) <sup>2</sup>	2 years tenant rate <sup>1</sup>	2 years rate ratio (95%CI) <sup>2</sup>	3+ years tenant rate <sup>1</sup>	3+ years rate ratio (95%CI) <sup>2</sup>
Total acute and arranged hospital admissions	208.6	192.5	0.92 (0.91, 0.94)	178.0	0.85 (0.84, 0.87)	171.5	0.82 (0.81, 0.84)	165.4	0.79 (0.78, 0.81)
Total Potentially avoidable hospitalisations	68.7	61.4	0.89 (0.87, 0.92)	56.2	0.82 (0.79, 0.84)	54.5	0.79 (0.77, 0.82)	52.7	0.77 (0.74, 0.79)
Potentially avoidable hospitalisations – Housing-related	33.8	29.6	0.88 (0.84, 0.91)	25.5	0.75 (0.72, 0.78)	23.4	0.69 (0.66, 0.73)	22.2	0.66 (0.62, 0.69)
Close contact infectious diseases	31.7	29.3	0.92 (0.89, 0.96)	24.4	0.77 (0.74, 0.81)	23.0	0.73 (0.69, 0.77)	22.8	0.72 (0.68, 0.76)
Circulatory and respiratory disease hospitalisations	39.4	35.6	0.90 (0.87, 0.94)	32.0	0.81 (0.78, 0.85)	30.6	0.78 (0.74, 0.82)	30.5	0.78 (0.74, 0.81)
Mental and behavioural disorder hospitalisations	10.7	8.9	0.84 (0.78, 0.90)	8.1	0.76 (0.70, 0.82)	7.5	0.71 (0.65, 0.77)	5.9	0.55 (0.50, 0.60)
Home injury hospitalisations	6.3	6.1	0.96 (0.88, 1.05)	5.6	0.89 (0.81, 0.98)	5.2	0.83 (0.74, 0.92)	5.0	0.79 (0.71, 0.88)
Injury in other specified places	14.5	12.3	0.85 (0.80, 0.90)	10.9	0.75 (0.70, 0.81)	11.3	0.78 (0.73, 0.84)	10.6	0.73 (0.68, 0.79)
Neoplasm hospitalisations	2.7	2.2	0.81 (0.68, 0.95)	1.9	0.72 (0.60, 0.85)	2.3	0.85 (0.71, 1.03)	2.8	1.05 (0.88, 1.25)

<sup>1</sup>Rate: cases per 1000 per year

<sup>2</sup>This is the rate ratio for the rate in that year compared with the reference rate (ref), which in this case is the pre-tenant rate

#### 10.4. Cohorts of applicants and tenants with time period comparisons

**Table 10.4: Hospitalisation rate for cohorts of social housing applicants and tenants, based on time periods in relation to individual tenancy start date or HNZN waiting list exit date, age-ethnicity standardised rates for people at start age 5-65 years (with 95% CI)**

Condition		Year 2 pre-tenant rate <sup>1</sup> (a)	Year 2 pre-tenant rate ratio (95%CI) (a vs. b)	Year 1 pre-tenant rate <sup>1</sup> (ref, b)	Year 1 post-tenant rate <sup>1</sup> (c)	Year 1 post-tenant rate ratio (95%CI) (c vs. b)	Year 2 post-tenant rate <sup>1</sup> (d)	Year 2 post-tenant rate ratio (95%CI) (d vs. b)	Year 2 post-tenant rate ratio (95%CI) (d vs. a)
Total acute and arranged hospital admissions	Long Term tenants (2+ years)	139.9	0.82 (0.80, 0.84)	171.4	149.8	0.87 (0.85, 0.89)	153.9	0.90 (0.88, 0.92)	1.10 (1.07, 1.13)
	Unsuccessful applicants	122.4	0.82 (0.80, 0.84)	148.6	122.1	0.82 (0.80, 0.84)	125.7	0.85 (0.83, 0.87)	1.03 (1.00, 1.05)
Total potentially avoidable hospitalisations	Long Term tenants (2+ years)	42.3	0.80 (0.77, 0.84)	52.6	46.5	0.88 (0.85, 0.92)	46.6	0.89 (0.85, 0.92)	1.10 (1.05, 1.15)
	Unsuccessful applicants	33.9	0.85 (0.81, 0.89)	40.0	32.7	0.82 (0.78, 0.86)	33.8	0.85 (0.80, 0.89)	1.00 (0.95, 1.05)
Housing-related potentially avoidable hospitalisations	Long Term tenants (2+ years)	17.4	0.80 (0.74, 0.85)	21.8	19.0	0.87 (0.81, 0.93)	19.7	0.90 (0.85, 0.96)	1.13 (1.06, 1.22)
	Unsuccessful applicants	14	0.85 (0.78, 0.91)	16.6	14.1	0.85 (0.79, 0.92)	15.6	0.94 (0.87, 1.02)	1.11 (1.03, 1.20)
Close contact infectious diseases	Long Term tenants (2+ years)	16.5	0.84 (0.78, 0.90)	19.6	18.0	0.92 (0.86, 0.99)	19.3	0.98 (0.92, 1.05)	1.17 (1.09, 1.26)
	Unsuccessful applicants	13.1	0.94 (0.87, 1.02)	13.9	12.3	0.88 (0.81, 0.96)	13.6	0.98 (0.90, 1.06)	1.04 (0.96, 1.12)
Circulatory and respiratory disease hospitalisations	Long Term tenants (2+ years)	19.2	0.80 (0.75, 0.85)	26.6	21.9	0.82 (0.77, 0.88)	22.9	0.86 (0.81, 0.92)	1.08 (1.01, 1.15)
	Unsuccessful applicants	18.8	0.90 (0.84, 0.97)	20.9	16.5	0.79 (0.74, 0.85)	17.7	0.85 (0.79, 0.91)	0.94 (0.87, 1.01)

Mental and behavioural disorder hospitalisations	Long Term tenants (2+ years)	12.8	0.92 (0.86, 0.99)	13.9	8.3	0.60 (0.56, 0.65)	8.0	0.58 (0.53, 0.62)	0.62 (0.57, 0.68)
	Unsuccessful applicants	12.5	0.86 (0.81, 0.92)	14.5	10.5	0.73 (0.68, 0.78)	9.1	0.63 (0.59, 0.67)	0.73 (0.68, 0.78)
Home injury hospitalisations	Long Term tenants (2+ years)	4.0	0.63 (0.56, 0.72)	6.4	4.6	0.73 (0.64, 0.82)	4.5	0.71 (0.63, 0.80)	1.12 (0.98, 1.28)
	Unsuccessful applicants	4.3	0.92 (0.81, 1.04)	4.7	4.5	0.96 (0.85, 1.08)	3.4	0.73 (0.63, 0.83)	0.79 (0.69, 0.91)
Injury in other specified places	Long Term tenants (2+ years)	8.6	0.81 (0.74, 0.89)	10.6	8.9	0.84 (0.77, 0.92)	7.6	0.67 (0.60, 0.74)	0.82 (0.74, 0.91)
	Unsuccessful applicants	9.2	1.02 (0.93, 1.12)	9.0	8.9	0.99 (0.89, 1.08)	8.5	0.94 (0.85, 1.04)	0.93 (0.84, 1.03)
Neoplasm hospitalisations	Long Term tenants (2+ years)	0.9	0.58 (0.44, 0.76)	1.6	1.6	1.00 (0.79, 1.27)	1.2	0.98 (0.78, 1.32)	1.70 (1.30, 2.23)
	Unsuccessful applicants	0.9	0.42 (0.32, 0.56)	2.1	1.6	0.78 (0.61, 1.00)	1.1	0.53 (0.42, 0.68)	1.27 (0.94, 1.27)

<sup>1</sup>Rate: cases per 1000 per year

<sup>2</sup>This is the rate ratio for the rate in that year compared with a specified reference rate (which varies, as specified)