Chapter 5: Household Crowding and Health

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Introduction
This chapter reviews some of the evidence that demonstrates a link between household crowding and health. It also presents descriptive data on the distribution of three important infectious diseases in New Zealand and explores how this is related to levels of household crowding at the neighbourhood level.

Measuring crowding
This report defines household crowding as a situation where one or more additional bedrooms are required to meet the sleeping needs of the household. This standard was first used in Canada so is sometimes called the Canadian National Occupancy Standard (CNOS).3 Statistics New Zealand has adopted this standard in recent reports4 as have other agencies, including the Australian Bureau of Statistics5 and Housing New Zealand Corporation (HNZC).

Household crowding, as measured by a deficit of one or more bedrooms, was relatively uncommon in New Zealand in 2001, accounting for 5.1 percent (65,091) of households. Only 1.2 percent (15,453) required two or more bedrooms. These census findings are consistent with results of the 1996/7 New Zealand Health Survey, which found that 7.8 percent of those aged 15 to 64 lived in overcrowded conditions (based on needing one or more additional bedrooms).6 The 2001 Census also identified that levels of crowding had decreased over time in most parts of New Zealand, except Auckland, where crowding increased numerically but declined proportionately.

Crowding is not evenly distributed across the population. As the analysis in this report has shown, it is highly concentrated in some population groups (chapter 3) and geographic areas (chapter 4). Low-income families with children, households containing Māori and Pacific people and households with recent migrants are more likely to experience crowding. There is

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2. The authors would like to acknowledge the assistance of the following people: Jasminka Milosevic, Wellington School of Medicine and Health Sciences, for assistance with the literature review of the effects of household crowding on mental health and psychological well being; Tony Blakely, Wellington School of Medicine and Health Sciences, for helpful comments on the methodology; Mark Wheldon and Alex Bayley, Analysts, Statistics New Zealand, for helping with SAS programs and compiling the maps, respectively; Robyn Bishop and Brenda Colville of Geoframes, SNZ, for the extra geocoding; Peter O’Brien, SNZ for supplying population data; and The Institute of Environmental Science and Research Limited (ESR), supplier of the notification data, which was collected on behalf of the Ministry of Health.
also evidence that levels of crowding have risen for some groups. While overall crowding levels reduced between 1986 and 1996, the gaps between crowding among Māori and Pacific families and other groups increased.

These findings are also validated by research carried out by the Māori Women’s Housing Research Project, which examined the housing conditions of Māori women in Gisborne/East Coast, South Auckland and Christchurch. It found that crowding, both temporary and permanent, and varying degrees of homelessness were common among the families studied.

Health Effects of Household Crowding

There is a relatively small amount of robust evidence showing a link between household crowding and disease. Most of this evidence relates to infectious disease and mental health.

Infectious Diseases

Much of the thinking about household crowding has focused on its potential role as a risk factor for infectious diseases, particularly those with respiratory spread. New Zealand is experiencing a severe and prolonged meningococcal disease epidemic and sustained high rates of locally acquired tuberculosis, rheumatic fever, and childhood pneumonia. Rates of hospitalisations for infectious diseases generally rose markedly during the 1990s.

In New Zealand, the link between household crowding and illness has been convincingly demonstrated for meningococcal disease. A case-control study conducted from 1997 to 1999 compared 202 cases of meningococcal disease in Auckland children with a control group of 313 children. Risk of disease was strongly associated with household crowding, as measured by the number of adolescent and adult (10 years or older) household members per room. This association would mean a doubling of risk with the addition of two adolescents or adults to a six-room house. The association applied equally to all ethnic groups and there was no threshold effect. Household crowding is also highly likely to contribute to other infectious diseases, although, except for meningococcal disease, this link has not been thoroughly investigated in New Zealand.

The association between crowding and meningococcal disease has been shown in institutional settings as far back as World War One and more recently for children in the UK, Ireland, and South Africa. Some studies have found the association with crowded housing to be overwhelmed by a stronger association with passive smoking.

Acute rheumatic fever has also long been associated with crowded living conditions: in the UK in the 1930s, the US in the 1950s, and more recently in New Zealand. One of the few

15. Glover (1920) 133-165.
What is the extent of crowding in New Zealand?

studies to investigate this disease using robust epidemiological methods was carried out in Yugoslavia in 1982 and found a significantly increased risk associated with home crowding. Tuberculosis has been linked, at the neighbourhood level, to crowding as a risk factor in New York, London and Birmingham, and tuberculosis death rates to levels of overcrowding of local authorities across England and Wales.

Several well-designed studies have found that children living in crowded households are vulnerable to a range of respiratory infections. Case-control studies carried out in the United States have found household crowding and large household size to be risk factors for Haemophilus influenzae infection, which causes a range of bacterial infections in children similar to meningococcal diseases. Respiratory syncytial virus, which is the most important cause of pneumonia and croup in children worldwide, has been found to be linked with crowded homes in Norway and Alaska. A Brazilian study found that hospitalisation with pneumonia in children less than two years of age was associated with household size of more than six people. And a case-control study in Israel found that the risk of chronic ear infection was associated with larger families and higher crowding levels.

The link between respiratory infectious diseases and crowded living conditions is highly plausible given that crowding increases contact between people who are susceptible and those who are infected or carrying the organism. Crowding may also increase exposure to infectious co-factors, or exposure to tobacco smoke, further increasing the risk of respiratory disease.

Household crowding also increases the risk of infectious diseases transmitted by other means. This includes enteric diseases such as hepatitis A; Helicobacter pylori infection, which is an important cause of stomach ulceration and cancer and acute diarrhoeal illness in pre-term infants. There is also some evidence for blood-borne diseases that may be transmitted by direct physical contact. A study that tested blood specimens from Kawerau children showed the risk of hepatitis B infection rose with increasing household size. There is also evidence that household crowding may increase the risk of conjunctivitis in outbreak situations, and head lice.

A small amount of research has also identified an association between household crowding and non-infectious outcomes, including pedestrian injuries in children, burns in children,
and, at a neighbourhood level, household size and mortality from myocardial infarction.\textsuperscript{45} A New Zealand cot death study found that while the risk of cot death increased with increasing household density, this effect lost statistical significance when other risk factors were included in the analysis.\textsuperscript{46}

**Mental Health and Psychological Well-being**

It is widely assumed that crowding represents a threat to mental health, though the evidence base for this is less than for the physical effects of crowding. The range of mental health outcomes extends from psychological symptoms such as anxiety, irritableness, sleeping difficulties and depression to well-defined mental illness. In such studies it is difficult to separate the effects of crowding from other aspects of housing conditions, such as noise, cold, and dampness,\textsuperscript{47} living in high\textsuperscript{48} rise buildings and run-down neighbourhoods, and lack of control over these conditions.\textsuperscript{49}

There is little evidence from New Zealand about the relationship between mental health and crowding. Mental illness or stress symptoms were cited in a New Zealand study of low-income residents from Auckland and Christchurch as health problems they perceived as being caused or exacerbated by housing conditions; however, they did not emerge as significant predictors of mental health.\textsuperscript{50} A recent study of Pacific families living in New Zealand found an association between cold and damp housing and postnatal depression in new mothers.\textsuperscript{51} The Mäori Women’s Housing Project found that Mäori women in rural and urban areas considered that crowding was associated with stressful situations and family violence.\textsuperscript{52}

Internationally, some studies have been published linking crowding and poor mental health outcomes. One large cross-sectional study in Chicago found a strong association between crowding and poor mental health.\textsuperscript{53} Ecological research in London found that crowding was associated with psychiatric re-admissions.\textsuperscript{54}

There have been only a few methodologically sound studies that have measured the effects of crowding and housing quality on psychological distress.\textsuperscript{55} A study in Thailand found a link between perceived lack of privacy, psychological distress and self-reported health.\textsuperscript{56} Situations where families double up in households were associated with stress in Jakarta\textsuperscript{57} and among Hong Kong residents living in multi-storey housing.\textsuperscript{58}

The relationship between crowding and mental health may not be consistent or linear.\textsuperscript{59} There is some evidence for increased psychological symptoms for both low-density and high-density housing.\textsuperscript{60} This relationship between housing and mental health is particularly noticeable in people with mental illness.\textsuperscript{61} Poor mental health may affect people’s ability to

\textsuperscript{45} Wong et al (2001) 159-163.
\textsuperscript{46} Schluter et al (1997) 243-246.
\textsuperscript{47} Martin et al (1987) 1125-1127.
\textsuperscript{50} Smith et al (1992) 2-10.
\textsuperscript{51} Butler et al (2003).
\textsuperscript{52} Mäori Women’s Housing Research Project Report (1994).
\textsuperscript{53} Gove et al (1979) 59-80.
\textsuperscript{54} Hwang et al (1999).
\textsuperscript{55} Evans (2000) 526-530.
\textsuperscript{56} Fuller et al (1993) 1417-1428.
\textsuperscript{57} Clauson-Kaas et al (1997).
\textsuperscript{58} Mitchell (1976).
\textsuperscript{61} Kearns (1995) 5-11.
What is the extent of crowding in New Zealand?

access and maintain adequate housing, while poor housing may exacerbate mental conditions. People who applied for re-housing on the grounds of mental ill health showed improvement in mental health symptoms.62

Crowding is more likely to have a detrimental effect on the psychological well-being of those who are unable to find ways to reduce their stress, such as solo parents, the elderly, children and those whose network of social support has been disrupted, such as immigrants with a language barrier.63 Psychological distress due to crowding is mitigated by the individual’s ability to exert power in the context of the household. More powerful members of a household can minimise negative effects by their greater ability to organise space and activities at home.64

There is some evidence that children may be particularly vulnerable to the effects of household crowding. A New York study of four-year-old children found that children living in crowded homes had more severe behavioural and cognitive development problems.65 A household survey in West Belfast found an association between crowding and psychological distress among children.66 A cross-sectional study of children aged 10–12 years in India found poorer academic achievement and conflict among those living in more crowded situations.67

The need for privacy as a prerequisite for achieving comfort and better mental health may be ethnically and culturally determined.68 A study by Evans found that Asian and Latino cultures reported less psychological stress than white Americans when living in overcrowded homes. However, at the biological level, as measured both by skin conductance and by task performance, all three cultural groups showed a similar stress response. The authors concluded that there are no differences between different ethnic groups in response to crowding.69

A link between crowding and psychological distress and poor mental health seems biologically plausible. Crowding is associated with information and stimulus overload, fewer behaviour choices, increased unpredictability in the behaviour of others and anxiety triggered by invasion of personal space.70 As an adaptation to over-stimulation from a crowded immediate environment, people may withdraw from social interaction with members of their household and community.71

Crowding and Infectious Diseases – Relationship at the Small Area Level

Method

The relationship between household crowding and health was investigated by exploring the distribution of infectious disease in relation to levels of household crowding. This analysis used the crowding quintile of the area unit (AU) as the marker of exposure to household crowding. The diseases chosen for analysis were those where New Zealand has unusually high rates, and household crowding is considered to be a potential risk factor. These diseases were meningococcal disease, acute rheumatic fever and tuberculosis.

Disease rates and maps were compiled using a combination of Ministry of Health notification data (collected by the Institute of Environmental Science and Research (ESR) Ltd) and census data. The data included all notified cases of meningococcal disease, acute rheumatic fever and tuberculosis in New Zealand from 1998–2002.

Area units were assigned crowding quintiles according to the CNOS; that is, they were based on the proportion of households with a deficit of one or more bedrooms (as described in the glossary). The level of household crowding varied from 0–1.75 percent in quintile 1, 1.76–2.66 percent in quintile 2, 2.67–4.04 percent in quintile 3, 4.05–6.90 percent in quintile 4 and reached 6.91–43.54 percent in quintile 5.

Disease rates by crowding quintile were calculated using 2001 Census data. The number of cases in each quintile and each sub-population (by area, ethnicity and age) were counted for the five-year period. The ethnicities used were Māori, European and Pacific peoples. Statistics New Zealand used the census data to calculate the denominator population of each quintile and also the size of each sub-population (by area, age, and ethnic group). These figures were combined with disease incidence expressed as an average annual rate per 100,000 population.

Population characteristics and levels of crowding varied markedly across New Zealand. The age and ethnic structures of each quintile were different, with quintile 5, for example, having a younger age structure. Almost half of Auckland’s usually resident population (who lived in an area unit that had been assigned a crowding quintile) was included in quintile 5, compared with just 0.8 percent of the South Island’s usually resident population.

This analysis was based on 2,558 cases of meningococcal disease, 1,837 cases of tuberculosis and 460 cases of acute rheumatic fever that occurred between 1998 and 2002. The analysis of disease rates by ethnicity was confined to people of Māori, Pacific peoples and European ethnicity. Cases were excluded from this analysis if they could not be assigned to an area unit or if the area unit they lived in was too small to be assigned a crowding quintile (fewer than 50 households). In total, 76 (2.8 percent) of the meningococcal disease cases, 87 (4.5 percent) of the tuberculosis cases and 48 (9.5 percent) of the acute rheumatic fever cases were excluded.

**Meningococcal Disease**

The following maps (figures 5.1 and 5.2) show the distribution of cases of meningococcal disease in the Auckland and East Cape areas. These cases have been superimposed on the maps where area units are shaded according to their crowding quintile. Cases appear clustered in area units with higher levels of crowding.
What is the extent of crowding in New Zealand?

Figure 5.1

Cases of Meningococcal Disease by Area Unit
For Auckland territorial authorities
Total for 1998–2002

Figure 5.2

Cases of Meningococcal Disease
By census area unit for East Cape territorial authorities
Total for 1998–2002

A more meaningful analysis is to look at rates of disease by crowding quintile. For meningococcal disease, the incidence increased from 6.7 cases per 100,000 in the least crowded quintile to 27.8 cases per 100,000 in the most crowded quintile.

To understand this relationship better, it is useful to look at disease rates by age, ethnicity and area. As figure 5.3 shows, rates of meningococcal disease were highest in children under 15 years of age, with particularly high rates among those under five years. Within each of these age groups, rates increased markedly for those living in the more crowded quintiles. Comparing the most crowded quintile with the least crowded, there was a four-fold increase in rates for children under five years of age, and a five-fold increase for children aged 5–14 years.

**Figure 5.3**

Rates of Meningococcal Disease per 100,000 Population

*By age group and crowding quintile*

Annual average for 1998–2002

Analysing by ethnicity showed that rates were higher for Māori and Pacific people compared with Europeans (Figure 5.4). Again, rates were markedly higher among those living in the most crowded areas.

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Figure 5.4

Rates of Meningococcal Disease per 100,000 Population for Children (0–14 Years)
By ethnic group and crowding quintile
Annual average for 1998–2002


Analysing by geographic area (Auckland, rest of North Island, and South Island) again showed that rates were markedly higher among those living in the most crowded quintiles, regardless of region (Figure 5.5).
What is the extent of crowding in New Zealand?

Figure 5.5

Rates of Meningococcal Disease per 100,000 Population for Children (0–14 Years)
By geographic area and crowding quintile
Annual average for 1998–2002

![Bar chart showing rates of meningococcal disease by geographic area and crowding quintile.](chart)


**Acute Rheumatic Fever (ARF)**

The following maps (Figures 5.6 and 5.7) show the distribution of cases of acute rheumatic fever (ARF) in the Auckland and East Cape areas. These cases have been superimposed on maps where the area units are shaded according to their crowding quintile. As with meningococcal disease, cases of ARF appear clustered in area units with higher levels of crowding.
Figure 5.6

Cases of Acute Rheumatic Fever by Area Unit
For Auckland territorial authorities
Total for 1998–2002

Figure 5.7

Cases of Acute Rheumatic Fever by Area Unit

For East Cape territorial authorities

Total for 1998–2002

Analysing rates of disease by crowding quintile showed that ARF incidence increased from 0.2 cases per 100,000 in the least crowded quintile to 7.8 cases per 100,000 in the most crowded quintile.

As Figure 5.8 shows, rates of ARF are highest in children 5–14 years of age, with lower rates among those 15–29 years, and very few cases in other age groups. Within these two age groups, rates increase markedly for those living in the more crowded quintiles. Comparing the most crowded quintile with the least crowded, rates increased by 32-fold for children aged 5–14 years and by a similar amount for people aged 15–29 years.

**Figure 5.8**

*Rates of Acute Rheumatic Fever per 100,000 Population*

*By age group and crowding quintile*

*Annual average for 1998–2002*


Analysing by ethnicity (Figure 5.9) shows that rates are higher for Māori and Pacific people, compared with Europeans. Again, rates are markedly higher among those living in the most crowded quintile.
What is the extent of crowding in New Zealand?

Figure 5.9
Rates of Acute Rheumatic Fever per 100,000 Population for Children (0–14 Years)
By ethnic group and crowding quintile
Annual average for 1998–2002

<table>
<thead>
<tr>
<th>Ethnic Group</th>
<th>Quintile 1</th>
<th>Quintile 2</th>
<th>Quintile 3</th>
<th>Quintile 4</th>
<th>Quintile 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>European</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Māori</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pacific</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>


Analysing by geographic area (Auckland, rest of North Island, and South Island) again shows that rates of ARF are markedly higher among those living in the most crowded quintile, regardless of region (Figure 5.10).
Figure 5.10
Rates of Acute Rheumatic Fever per 100,000 Population
for Children (0–14 Years)
By geographic area and crowding quintile
Annual average for 1998–2002


Tuberculosis
The following maps (Figures 5.11 and 5.12) show the distribution of cases of tuberculosis in the Auckland and East Cape areas. These cases have been superimposed on maps showing levels of crowding at the area unit level. Cases appear clustered in area units with higher levels of crowding.
What is the extent of crowding in New Zealand?

Figure 5.11

Cases of Tuberculosis by Area Unit
For Auckland territorial authorities
Total for 1998–2002

Figure 5.12

Cases of Tuberculosis by Area Unit
For East Cape territorial authorities
Total for 1998–2002

Analysing rates of disease by crowding quintile showed that tuberculosis incidence increased from 2.4 cases per 100,000 in the least crowded quintile to 18.7 cases per 100,000 in the most crowded quintile.

As Figure 5.13 shows, rates of tuberculosis are highest in those over 60 years, with a second peak in those aged 15–29 years. The association with crowding quintile was apparent across all age groups but was most marked among the young. Comparing the most crowded quintile with the least crowded, rates for those aged 0–4 years increased 25-fold, and rates for those aged over 60 years increased five-fold.

**Figure 5.13**

*Rates of Tuberculosis per 100,000 Population*

*By age group and crowding quintile*

*Annual average for 1998–2002*


Analysing by ethnicity (Figure 5.14) showed that rates were higher for Māori and Pacific people compared with Europeans. Again, rates were markedly higher among those living in the most crowded quintile.
Figure 5.14

Rates of Tuberculosis per 100,000 Population
By ethnic group and crowding quintile
Annual average for 1998–2002


Analysing by geographic area (Auckland, rest of North Island, and South Island) again shows that rates of tuberculosis are markedly higher among people living in the most crowded quintiles regardless of region (Figure 5.15).
Figure 5.15
Rates of Tuberculosis per 100,000 Population
By geographic area and crowding quintile
Annual average for 1998–2002

Establishing the relationship between crowding and infectious disease

These New Zealand findings are consistent with overseas ‘ecological’ studies that have found higher rates of infectious diseases in areas with higher proportions of crowded households. This association has been seen most consistently for tuberculosis, but also for acute rheumatic fever, meningococcal and pneumococcal meningitis and meningococcal disease. Crowding is often measured as part of a composite deprivation score. Many disease outcomes are found to be associated with deprivation measured in this way. In the UK, for example, meningococcal disease, tuberculosis, and hospital admissions for infectious intestinal diseases are significantly higher in more deprived areas, as measured by their Townsend scores. Townsend scores are a composite deprivation score based on the proportion who are unemployed, do not own a car, and do not own their own home, as well as those living in houses that have more than one person to a room.

Such analyses have a number of limitations in terms of being able to establish a causal link between observed levels of household crowding and disease. The following table shows the characteristics of crowded households compared with those defined as not crowded, using the Canadian National Occupancy Standard. It also compares the characteristics of the least and most crowded area unit quintiles.

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### Figure 5.16
**Comparisons of Household Classified as Crowded and Not Crowded and those in the Most Crowded Quintile and Least Crowded Quintile of Area Units**
*By selected households and individual characteristics*
*For 2001*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total</th>
<th>Not crowded households (CNOS)</th>
<th>Crowded households (CNOS)</th>
<th>Least crowded CAU quintile</th>
<th>Most crowded CAU quintile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of households</td>
<td>1,344,267</td>
<td>1,220,916</td>
<td>65,088</td>
<td>207,456</td>
<td>285,312</td>
</tr>
<tr>
<td>Household structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Couple only (with or without others) %</td>
<td>27.1%</td>
<td>28.9%</td>
<td>1.3%</td>
<td>32.8%</td>
<td>20.1%</td>
</tr>
<tr>
<td>Couple with children (with or without others) %</td>
<td>29.7%</td>
<td>29.7%</td>
<td>38.9%</td>
<td>32.7%</td>
<td>29.1%</td>
</tr>
<tr>
<td>One parent with children (with or without others) %</td>
<td>12.3%</td>
<td>11.2%</td>
<td>33.4%</td>
<td>8.1%</td>
<td>17.5%</td>
</tr>
<tr>
<td>Two or more family household %</td>
<td>2.2%</td>
<td>1.3%</td>
<td>18.4%</td>
<td>0.9%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Other household composition %</td>
<td>28.7%</td>
<td>28.9%</td>
<td>6.0%</td>
<td>25.5%</td>
<td>28.4%</td>
</tr>
<tr>
<td>Family size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average number of people in household</td>
<td>2.67</td>
<td>2.54</td>
<td>5.35</td>
<td>2.57</td>
<td>3.01</td>
</tr>
<tr>
<td>Median number of people in household</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>House size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average number of rooms</td>
<td>6.15</td>
<td>6.20</td>
<td>5.42</td>
<td>6.58</td>
<td>5.74</td>
</tr>
<tr>
<td>Average number of bedrooms</td>
<td>3.05</td>
<td>3.07</td>
<td>2.76</td>
<td>3.22</td>
<td>2.04</td>
</tr>
<tr>
<td>Median number of rooms</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Median number of bedrooms</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>People per room and room deficit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average people per room</td>
<td>0.46</td>
<td>0.43</td>
<td>1.05</td>
<td>0.40</td>
<td>0.56</td>
</tr>
<tr>
<td>Average people per bedroom</td>
<td>0.91</td>
<td>0.85</td>
<td>2.01</td>
<td>0.82</td>
<td>1.06</td>
</tr>
<tr>
<td>Short 1 or more bedrooms %</td>
<td>5.1%</td>
<td>0</td>
<td>100.0%</td>
<td>1.3%</td>
<td>12.6%</td>
</tr>
<tr>
<td>Short 2 or more bedrooms %</td>
<td>1.2%</td>
<td>0</td>
<td>23.7%</td>
<td>0.1%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Age structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average age</td>
<td>34.9</td>
<td>36.0</td>
<td>23.7</td>
<td>37.5</td>
<td>31.4</td>
</tr>
<tr>
<td>Median age</td>
<td>34</td>
<td>36</td>
<td>20</td>
<td>38</td>
<td>30</td>
</tr>
<tr>
<td>Average number of children &lt;15 years per household</td>
<td>0.62</td>
<td>0.6</td>
<td>2.0</td>
<td>0.6</td>
<td>0.8</td>
</tr>
<tr>
<td>Median number of children &lt;15 years per household</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Households with children &lt; 15 years %</td>
<td>32.9%</td>
<td>30.7%</td>
<td>79.8%</td>
<td>30.1%</td>
<td>40.0%</td>
</tr>
<tr>
<td>Ethnicity of household</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European %</td>
<td>85.5%</td>
<td>89.8%</td>
<td>52.9%</td>
<td>95.2%</td>
<td>66.4%</td>
</tr>
<tr>
<td>Maori %</td>
<td>15.0%</td>
<td>13.9%</td>
<td>40.8%</td>
<td>7.1%</td>
<td>27.3%</td>
</tr>
<tr>
<td>Pacific %</td>
<td>5.2%</td>
<td>4.5%</td>
<td>27.7%</td>
<td>11.1%</td>
<td>15.5%</td>
</tr>
<tr>
<td>Asian %</td>
<td>6.2%</td>
<td>5.7%</td>
<td>16.7%</td>
<td>3.2%</td>
<td>10.3%</td>
</tr>
<tr>
<td>Other %</td>
<td>0.8%</td>
<td>0.7%</td>
<td>2.3%</td>
<td>0.4%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Origins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Born overseas %</td>
<td>19.5%</td>
<td>18.3%</td>
<td>28.5%</td>
<td>15.0%</td>
<td>25.9%</td>
</tr>
<tr>
<td>Of people born overseas, arrived in NZ in previous 5 years %</td>
<td>27.5%</td>
<td>24.8%</td>
<td>43.9%</td>
<td>22.8%</td>
<td>31.7%</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No educational qualifications %</td>
<td>27.4%</td>
<td>26.5%</td>
<td>37.4%</td>
<td>24.6%</td>
<td>32.7%</td>
</tr>
<tr>
<td>Tenure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own house %</td>
<td>67.8%</td>
<td>69.6%</td>
<td>37.6%</td>
<td>78.0%</td>
<td>55.6%</td>
</tr>
<tr>
<td>Rent house %</td>
<td>32.2%</td>
<td>30.4%</td>
<td>62.4%</td>
<td>22.0%</td>
<td>44.4%</td>
</tr>
</tbody>
</table>
Figure 5.16 continued

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total</th>
<th>Not crowded households (CNOS)</th>
<th>Crowded households (CNOS)</th>
<th>Least crowded CAU quintile</th>
<th>Most crowded CAU quintile</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Income</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average JEAH</td>
<td>45,431</td>
<td>46,182</td>
<td>30,375</td>
<td>49,400</td>
<td>41,043</td>
</tr>
<tr>
<td>Median JEAH</td>
<td>34,689</td>
<td>36,319</td>
<td>25,398</td>
<td>41,544</td>
<td>34,420</td>
</tr>
<tr>
<td>Receipt of income from Government benefit (DPB, Community Wage, Invalids) but excluding superannuation and student allowance %</td>
<td>24.5%</td>
<td>22.9%</td>
<td>64.9%</td>
<td>16.5%</td>
<td>34.6%</td>
</tr>
<tr>
<td><strong>Resources</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Households with one or more motor vehicles %</td>
<td>89.9%</td>
<td>90.4%</td>
<td>85.2%</td>
<td>94.0%</td>
<td>84.9%</td>
</tr>
<tr>
<td>Households with one or more telephones %</td>
<td>96.3%</td>
<td>96.8%</td>
<td>87.7%</td>
<td>98.4%</td>
<td>92.5%</td>
</tr>
<tr>
<td><strong>Home heating</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combustion (one or more of mains gas, bottled gas, wood, coal) %</td>
<td>71.0%</td>
<td>71.8%</td>
<td>59.7%</td>
<td>76.7%</td>
<td>62.5%</td>
</tr>
<tr>
<td>Bottled gas %</td>
<td>28.3%</td>
<td>28.4%</td>
<td>28.1%</td>
<td>24.9%</td>
<td>29.3%</td>
</tr>
<tr>
<td>Never use any form of heating in dwelling %</td>
<td>2.7%</td>
<td>2.4%</td>
<td>7.8%</td>
<td>0.9%</td>
<td>5.7%</td>
</tr>
<tr>
<td><strong>Smoking (based on 1996 census)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any smoker in household (based on 1996 census) %</td>
<td>32.9%</td>
<td>32.1%</td>
<td>59.3%</td>
<td>26.6%</td>
<td>41.3%</td>
</tr>
<tr>
<td>Proportion of adults in household who smoke %</td>
<td>0.24</td>
<td>0.23</td>
<td>0.39</td>
<td>0.18</td>
<td>0.31</td>
</tr>
</tbody>
</table>

1. Smoking data is based on 1996 census.


These tabulated data illustrate the two most important limitations in the analysis presented in this chapter:

- **Confounding effects** – Crowding is highly associated with other measures of socio-economic deprivation such as low income, unemployment, low education level and fewer material resources such as cars and telephones. Other risk factors for respiratory disease, notably active and passive smoking, are also higher in such areas. Children living in a crowded house are almost twice as likely to have a smoker in the household as children in a house that is not crowded. These other risk factors could potentially explain (confound) some of the observed association between living in a residence in a more crowded neighbourhood and disease rates.

- **Ecological effects** – The area unit where a household is located is a less specific measure of exposure to crowding than household level census data. The average number of people per room is 1.05 for crowded houses, compared with 0.56 for houses in the most crowded quintile of area units. This same ecological effect is seen for all of the exposures listed in the above table. For example, 59.3 percent of households classified as crowded contain a smoker, compared with 41.3 percent of households in the most crowded area unit quintile. Assigning average area unit values to every household in that area unit will therefore provide a fairly imprecise measure of exposure.

Because of these limitations, it is not possible to ascribe causality to the observed associations between crowding and higher disease rates. However, these data do provide supporting evidence that is consistent with the results of more rigorous investigations of the link between household crowding and infectious disease.

**Conclusions and the Need for Further Research**

Despite the apparent weight of evidence, a recent New Zealand review of the effects of crowding on health concluded that “The debate about the relationship between crowding and health is long standing and inconclusive”. That review suggested that more research is needed to resolve this question. Researchers at the Wellington School of Medicine and Health Sciences conclude that there is sufficient evidence to support interventions to reduce
household crowding in New Zealand, at least as a strategy to reduce the risk of respiratory infectious diseases. Evaluating the impact of such interventions may also provide more robust evidence to support a causal relationship between housing conditions and health outcomes.

Partly based on evidence linking household crowding and meningococcal disease, Housing New Zealand Corporation (HNZC) has implemented its Healthy Housing Programme to reduce levels of crowding in its properties. HNZC is also collaborating with the Housing and Health Research Programme at the Wellington School of Medicine and Health Sciences on a cohort study of HNZC housing applicants and tenants. This study aims to investigate the relationship between levels of household crowding and hospitalisation for a wide range of health conditions. It will also assess the impact of the move from waiting list to being re-housed. Such research could add to the very scant literature on the health effects of housing improvements.

References


What is the extent of crowding in New Zealand?


What is the extent of crowding in New Zealand?


