Housing quality and resilience in New Zealand

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Housing quality and resilience in New Zealand

Amber L. Pearson, Lucy Telfar Barnard, Jamie Pearce, Simon Kingham and Philippa Howden-Chapman

There is extensive research on the negative health impacts of poor housing quality. However, little is known about the potential health benefits of high-quality housing in poor neighbourhoods. Neighbourhoods with unexpectedly good health outcomes despite high levels of deprivation have been deemed resilient places and housing quality in these areas may be a contributor to this resilience. This study aimed to evaluate whether an indicator of neighbourhood housing quality was associated with a previously quantified resilience index (RINZ) in New Zealand. It was found that areas with high housing quality tended to have higher median income, greater proportions of partnered people and shorter-term residents, and very low proportions of Māori. A positive association was found between housing quality and resilience, after adjustment for deprivation. There was no indication of differences by heterogeneity in housing quality within the aggregate unit of analysis. These findings pose the hypothesis that improving housing quality in similarly deprived areas that have poor health outcomes could potentially boost health. To extend this understanding, further development of a more sophisticated housing quality indicator is recommended.

Keywords: built environment, health, housing, resilience

Introduction

Housing is important to many aspects of life, not only as shelter and storage facility, but also as a place for social connection. Cold and damp housing, substandard housing and overcrowding all influence health outcomes (Howden-Chapman, Crane, Baker, Cunningham, & Matheson, 2004; Krieger & Higgins, 2002), including poor mental health, psychological distress (Evans, Chan, Wells, & Saltzman, 2000), increased injuries (Keall, Baker, Howden-Chapman, & Cunningham, 2008), and infectious diseases (Jaine, Baker, & Venugopal, 2011), including respiratory diseases (Baker, Das, Venugopal, & Howden-Chapman, 2008). Much of the research on housing and health relates to quality of the housing, such as dampness and mould on walls, ceilings and windows, ventilation, insulation and warmth, and heating sources. Thus, housing quality assessment has been advised for public health research (Keall, Baker, Howden-Chapman, Cunningham, & Ormandy, 2010). In addition to the direct effects of housing quality, there are also several aspects of housing that have been shown to influence health, including density, type and crowding levels. Some evidence suggests that housing density, type and layout on streets influences neighbourhood interactions thus influencing social cohesion, trust and a collective sense of community, all of which have been associated with mental well-being (O’Campo,
Salmon, & Burke, 2009) and depression (Galea, Ahern, Rudenstine, Wallace, & Vlahov, 2005). One study found that dissatisfaction with housing was associated with high density and that terraced housing was consistently associated with increased dissatisfaction (Bramley & Power, 2009). On the other hand, housing density may also increase access to services and decrease car reliance (Fuller & de Jong, 2011), which may be particularly important for low-income areas. Household crowding is also a long-standing public health issue in New Zealand, defined as more than one occupant per bedroom (Statistics New Zealand, 1998). In the 1920s, 9% of homes were considered crowded (severely crowded by today’s definition). In 2006, 10% of the New Zealand resident population lived in households requiring one or more additional bedrooms. Crowding impacts all ethnicities in New Zealand, but is particularly severe among Pacific Peoples (43%) and Māori (23%) (SNZ, 2012).

While many poor neighbourhoods are characterized by poor-quality housing (e.g. insulation, dampness, heating) and high levels of associated health outcomes (Braubach & Fairburn, 2010), there may be some poor areas with high-quality housing and unexpectedly good health outcomes. The pathways through which high-quality housing supports health could include decreased respiratory disease (Wilkinson et al., 2009), blood pressure, stress and psychological issues (Jacobs, Wilson, Dixon, Smith, & Evans, 2009; Northridge, Ramirez, Stingone, & Claudio, 2010). Therefore, housing quality is one neighbourhood quality that may contribute to neighbourhood resilience.

In New Zealand, a measure of neighbourhood resilience (Resilience Index New Zealand – RINZ) was developed to characterize areas with unexpectedly low mortality despite high levels of material deprivation (Pearson, Pearce, & Kingham, 2013). Specifically, RINZ is a measure at the area level that quantifies unexpectedly low mortality, given levels of deprivation, percentage Māori and the number of aged-care facilities, or areas of regression model under- and over-prediction. In exploring the relationship between resilience and neighbourhood built environment characteristics, that study found that resilient places tended to be densely populated urban areas, and had decreased access to risk factors of unhealthy living such as gambling and alcohol outlets. However, the previous research did not evaluate one important aspect of the neighbourhood built environment: housing. Housing quality could foster positive health (and lower mortality) beyond expected levels in poor neighbourhoods, thus contributing to resilience, as defined in this research. This research aimed: (1) to understand the neighbourhood characteristics of places with varying levels of housing quality across New Zealand; (2) to evaluate whether high-quality housing is an important component of neighbourhood resilience, using a national index in New Zealand (RINZ); and (3) to understand whether any identified relationship was simply an artefact of heterogeneity in housing within the area unit.

Methods

Resilience data

This study evaluated resilience in small areas in New Zealand, utilizing the RINZ at the census area unit (CAU) level (n = 1484, median population = 2522), previously developed for health research (Pearson et al., 2013). The aim of developing RINZ was to capture areas experiencing the apparent paradox of poor neighbourhood socioeconomic conditions (deprivation) yet relatively good health outcomes. For a full discussion of the methods and data used to generate RINZ, see Pearson et al. (2013). Briefly, the index was created by fitting regression models of mortality rates and area-level deprivation, adjusted for potential confounders. Areas of model under- and over-prediction were then used to generate quintiles of high (5) to low (1) resilience.

Area-level deprivation was captured using the New Zealand Deprivation Index (NZDep) which comprised nine variables (e.g. employment, home and car ownership, and uptake of government assistance programmes) taken from the 2006 New Zealand census (Crampton, Salmon, & Kirkpatrick, 2004) and ranked to create deciles (1 = least deprived 10% of CAUs). Health data included age-standardized all-cause mortality rates for CAUs (averaged for 2005–2007).

Housing quality data

Quotable Value New Zealand (QV) is a crown-owned independent entity that holds and maintains data on all New Zealand properties. These data include a field for the general condition of the property, with ratings of ‘superior’, ‘average’ or ‘poor’ condition. While there is no formal validation of these ratings, QV ratings for overall dwelling condition have been found to be broadly similar to standardized assessment-based ratings assigned by the Building Research Association of New Zealand (BRANZ, 2005).

Most ratings are assigned on the basis of exterior inspection from the street, as closer inspections only occur following work requiring a building consent. Most properties are rated ‘average’ condition, and the rating for any individual property may be out of date; however, the data are meaningful in bulk comparing deviations from the mean. In 2006 QV property data were matched to New Zealand’s National Health Index addresses, providing a dataset of 1.08 million properties, approximately 67% of all New Zealand residences.
Creation of the housing quality index and heterogeneity strata

Dwelling quality ratings were assigned a value of 1 for ‘superior’ \( (n = 105\,788) \), 0 for ‘average’ \( (n = 865\,646) \) and \(-1\) for ‘poor’ \( (n = 51\,976) \). On average, 66% (95% CI = 65–67%) of dwellings in each CAU had a QV rating available. A Housing Quality Index (HQI) was then created at CAU level by averaging the quality value over the CAU, then ranking these averages and dividing them into deciles. Next, an indicator for heterogeneity of housing quality within a CAU was generated by calculating the variance of the quality measure for all the houses within each CAU (mean = 77, SD = 119, minimum = 0, maximum = 1247). Then, for each CAU, variance values above the national average were categorized as having high heterogeneity \( (n = 821) \) and areas with values below the mean were categorized as having low heterogeneity \( (n = 663) \).

Neighbourhood characteristics data

In order to describe the neighbourhood characteristics of areas with varying levels of housing quality, characteristics were selected that were identified as relevant from a review of the New Zealand literature relating to environmental and neighbourhood effects on health as well as pragmatic considerations relating to data availability. Health-related neighbourhood characteristics of the built, physical and social environment were previously compiled from a variety of data sources (for sources, see Table 1). All measures were calculated by CAU, except the population change variable which was constructed at the territorial authority level. Pre-calculated measures relating to access (high = 1 to low = 5) to healthcare, healthy living infrastructure and educational facilities (Pearce, Day, & Witten, 2008; Pearce, Mason, Hiscock, & Day, 2008; Pearce, Witten, & Bartie, 2006) and environmental deprivation (Pearce et al., 2011) were used. These data were originally obtained from a variety of sources including the Department of Internal Affairs, Liquor Advisory Council, Ministry of Education, and Ministry of Health. Additionally, access to unhealthy living infrastructure was calculated by measuring distances along the road network from population-weighted centroids of each CAU to the nearest gambling and alcohol outlets. Variables characterizing the social environment within CAUs were also calculated, such as the percentages of long-term residents, of smokers, of ethnicities, and partnered and median income using 2006 census data.

Statistical analyses

Every CAU across the country that had both resilience and housing quality values \( (n = 1484) \) was included. In order to understand the relationship between housing quality and resilience across neighbourhoods in New Zealand, two ordinal logistic regression models were fitted and they are appropriate when the outcome variable is ordered categorical. The parameters of ordinal logistic, or proportional odds, models compare the exposure odds ratios for being in the highest categories compared with the lowest categories (Kirkwood & Sterne, 2003). The first model included resilience quintiles as the dependent variables and housing quality deciles and area-level deprivation deciles as independent variables. Area-level deprivation was included as a potential confounder, as the housing quality measure may suffer from assessor bias (i.e., prone to low-quality assessment in deprived areas). After running the model, the parallel or proportional odds assumption for ordinal logistic models was evaluated by obtaining an insignificant Chi\(^2\)-value of 6.19 \((p = 0.103)\) using the Brant test. Since these values were similar, the assumption was not rejected and alternative models were not deemed necessary.

The second regression model tested whether the previously identified association between housing quality and resilience was different in areas with either large or small differences in housing quality (i.e., whether the association was an artefact of heterogeneity within the aggregate unit (CAU)). To do this, the data were stratified into areas with high heterogeneity and areas with low heterogeneity. If this relationship was simply an artefact of heterogeneity, it would be expected that the stratified analyses yield different results compared with the regression models including the entire population. Thus, the above model was fitted for the two strata separately. Odds ratios and 95% confidence intervals for model estimates were reported. All analyses were conducted using Stata 12 software (College Station, TX, US).

Results

In descriptive analyses of characteristics of neighbourhoods with varying levels of housing quality, unsurprisingly, housing quality was found to be higher in areas with lower deprivation, percentage Māori and percentage smokers; while median income was higher (Table 1). However, the gradient for percentage European was less clear, where the highest percentage was found for decile 7. No difference was found in incoming residents (those who lived in the area for less than one year) across the quintiles, and a slight increase in the percentage of the population living in the area for five to nine years in the two highest quintiles for quality. Higher proportions of long-term residents (over 30 years) were found in areas with low housing quality and the lowest proportions in areas of high housing quality. There was a ‘U’-shaped relationship for percentage partnered, with the highest percentages in areas with low and high housing quality. Higher percentages of the population...
Table 1  Neighbourhood characteristics by housing quality deciles

<table>
<thead>
<tr>
<th>Decile</th>
<th>1 – Low</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10 – High</th>
<th>Source of data (year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td></td>
<td></td>
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<td>Statistics NZ (2006)</td>
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<td></td>
<td>Statistics NZ (2006)</td>
</tr>
<tr>
<td>Social</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Statistics NZ (2006)</td>
</tr>
<tr>
<td>Deprivation score</td>
<td>1061 (95)</td>
<td>1034 (78)</td>
<td>1020 (72)</td>
<td>1020 (76)</td>
<td>1013 (76)</td>
<td>1003 (65)</td>
<td>969 (49)</td>
<td>966 (49)</td>
<td>952 (41)</td>
<td>929 (31)</td>
<td>Statistics NZ (2006)</td>
</tr>
<tr>
<td>Median income*</td>
<td>208 000 (4300)</td>
<td>22 000 (4300)</td>
<td>22 700 (4800)</td>
<td>23 600 (5400)</td>
<td>24 100 (5300)</td>
<td>26 000 (6000)</td>
<td>27 600 (6000)</td>
<td>29 900 (6700)</td>
<td>Statistics NZ (2006)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage European</td>
<td>54 (23)</td>
<td>62 (17)</td>
<td>66 (15)</td>
<td>65 (14)</td>
<td>60 (17)</td>
<td>67 (13)</td>
<td>71 (9)</td>
<td>70 (10)</td>
<td>71 (10)</td>
<td>68 (11)</td>
<td>Statistics NZ (2006)</td>
</tr>
<tr>
<td>Percentage smokers</td>
<td>19 (4)</td>
<td>18 (4)</td>
<td>18 (5)</td>
<td>17 (4)</td>
<td>15 (5)</td>
<td>15 (4)</td>
<td>14 (3)</td>
<td>13 (3)</td>
<td>12 (3)</td>
<td>9 (3)</td>
<td>Statistics NZ (2006)</td>
</tr>
<tr>
<td>Percentage new residents</td>
<td>20 (7)</td>
<td>22 (6)</td>
<td>23 (6)</td>
<td>24 (8)</td>
<td>24 (6)</td>
<td>23 (8)</td>
<td>22 (6)</td>
<td>23 (7)</td>
<td>22 (5)</td>
<td>22 (8)</td>
<td>Statistics NZ (2006)</td>
</tr>
<tr>
<td>Percentage lived there for 5–9 years</td>
<td>16(3)</td>
<td>16 (3)</td>
<td>16 (3)</td>
<td>15 (3)</td>
<td>16 (3)</td>
<td>16 (3)</td>
<td>17 (3)</td>
<td>16 (3)</td>
<td>17 (3)</td>
<td>18 (4)</td>
<td>Statistics NZ (2006)</td>
</tr>
<tr>
<td>Percentage long-term residents</td>
<td>5 (3)</td>
<td>5 (2)</td>
<td>5 (3)</td>
<td>5 (2)</td>
<td>5 (2)</td>
<td>5 (2)</td>
<td>4 (2)</td>
<td>4 (2)</td>
<td>3 (2)</td>
<td>Statistics NZ (2006)</td>
<td></td>
</tr>
<tr>
<td>Percentage of the population aged 65+ years</td>
<td>10 (5)</td>
<td>11 (6)</td>
<td>13 (6)</td>
<td>12 (5)</td>
<td>11 (5)</td>
<td>13 (7)</td>
<td>14 (6)</td>
<td>14 (7)</td>
<td>15 (9)</td>
<td>14 (7)</td>
<td>Statistics NZ (2006)</td>
</tr>
<tr>
<td>Percentage partnered</td>
<td>56 (11)</td>
<td>58 (10)</td>
<td>58 (10)</td>
<td>55 (11)</td>
<td>55 (10)</td>
<td>56 (11)</td>
<td>61 (8)</td>
<td>60 (9)</td>
<td>62 (7)</td>
<td>63 (7)</td>
<td>Statistics NZ (2006)</td>
</tr>
<tr>
<td>Physical</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Statistics NZ (2006)</td>
</tr>
<tr>
<td>Environmental deprivation</td>
<td>2.9 (1.8)</td>
<td>2.7 (1.7)</td>
<td>3.0 (1.6)</td>
<td>3.5 (1.5)</td>
<td>3.3 (1.2)</td>
<td>3.5 (1.4)</td>
<td>3.4 (1.4)</td>
<td>3.1 (1.4)</td>
<td>2.9 (1.3)</td>
<td>3.2 (1.0)</td>
<td>Pearce, Richardson, Mitchell, &amp; Shortt (2011)</td>
</tr>
</tbody>
</table>

Notes: Access measures (5 = high, 1 = low); distance (km); and environmental deprivation (2 = high, –2 = low).
*Data in this table were taken from websites or provided direct to the authors: Statistics New Zealand, Census 2006, retrieved January 2012 from http://www.stats.govt.nz/Census/2006CensusHomePage.aspx; Ministry of Health (data provided direct to authors); Ministry of Education, retrieved in 2002 from: http://www.minedu.govt.nz/parents/allages/schoolsearch.aspx; Department of Internal Affairs in 2003 (data provided direct to authors); the Liquor Advisory Council in 2005 (data provided direct to authors).
over 65 years were observed in deciles 9 and 10 (high quality). Access to healthcare measures indicated generally lower access in areas of high housing quality. Access to schools was largely ‘U’-shaped, where the highest and lowest quality deciles had the best access. Yet, there were not great differences in access across the deciles. Distance to the nearest unhealthy living facilities indicated a general decline in distance across housing quality. Last, environmental deprivation exhibited a ‘U’-shaped relationship, with the least environmentally deprived areas being deciles 1 and 9 and the most deprived in deciles 4 and 6.

In comparing the geographic distribution of housing quality and resilience, many rural areas had poor housing quality, which was evident when examining

Figure 1  Map of resilience and housing quality: New Zealand
Figure 2  Map of resilience and housing quality: Auckland

Figure 3  Map of resilience and housing quality: Wellington
Figure 4  Map of resilience and housing quality: Christchurch

Table 2  Logistic regression results between RINZ and housing quality for the entire population and two heterogeneity strata

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2a</th>
<th>Model 2b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log-likelihood</td>
<td>−2377.2</td>
<td>−1306.2</td>
<td>−1501.5</td>
</tr>
<tr>
<td>AIC</td>
<td>4766.4</td>
<td>2624.5</td>
<td>2114.9</td>
</tr>
<tr>
<td>LR Chi²</td>
<td>22.4</td>
<td>14.4</td>
<td>12.4</td>
</tr>
<tr>
<td>Prob. &gt; Chi²</td>
<td>&lt;0.001</td>
<td>0.001</td>
<td>0.002</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Entire population</th>
<th>Areas of high heterogeneity</th>
<th>Areas of low heterogeneity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odds ratio</td>
<td>1.09 1.05 1.13</td>
<td>1.09 1.04 1.14</td>
<td>1.08 1.01 1.15</td>
</tr>
<tr>
<td>95% CI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality index</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deprivation</td>
<td>1.07 1.03 1.11</td>
<td>1.03 0.98 1.08</td>
<td>1.09 1.04 1.15</td>
</tr>
</tbody>
</table>

Note: AIC = Akaike information criterion; CI = confidence interval; LR = likelihood ratio.
the national map (Figures 1–4). Within the three major cities, Wellington had the most consistent coverage of high-quality housing, followed by Christchurch and Auckland. Christchurch’s central business district had the lowest housing quality compared with the other cities. In addition, the areas with high housing quality tended to be the most resilient within cities, whereas there was more variety in rural areas.

The results of regression analyses showed that the presence of higher quality housing was associated with a 1.09-fold increased odds of a higher level of resilience, adjusted for deprivation (Table 2). Thus, as resilience increased, so did quality housing, independent of deprivation. In assessing whether the association was simply an artefact of heterogeneity of housing quality within the aggregate unit (CAU), models for strata of high and low heterogeneity of housing quality within each CAU were fitted. Little change in the association was observed, suggesting that the association does not appear to be different in areas of high and low heterogeneity.

Discussion

Poor housing quality has been associated with myriad physical and mental health outcomes. This study evaluated whether at the area level high-quality housing was associated with community resilience, a measure which characterizes unexpectedly positive health outcomes in disadvantaged areas in New Zealand. A positive association between housing quality and resilience was found that did not differ by heterogeneity in housing quality within the aggregate unit of analysis. These findings indicate that housing quality partially explains neighbourhood resilience. While there are limitations, particularly in relation to uncertainty in the housing quality measure, this work poses the hypothesis that improving housing quality in similarly deprived areas that have poor health outcomes has the potential to boost health, and further research in this area is recommended.

Areas with high housing quality tended to have higher proportions of partnered people, shorter-term residents and very low proportions of Māori. Households with two partners may have an advantage in maintaining housing quality, purchasing a quality home or retrofitting an existing home to improve quality due to potentially higher income and labour and time resources. Areas with high-quality housing had fewer long-term residents, indicating that those living in homes for a longer duration were less likely to upgrade their homes and improve the quality. There is potential bias in that long-term residents will also tend to be older and therefore are more likely to have poorer health. However, this bias may be limited because the highest percentage of the population over 65 years old was also found in the highest quality decile. This may indicate that those who are able to get a new, better-quality home later in life also have better health, and those who cannot either retrofit their existing home or move to a new one may be less resilient. This could be due to their preferences, financial limits (although the study adjusted for deprivation) or perceived lack of importance. It is important to note that the mortality differences due to variations in age composition of the area units were adjusted in the development of the resilience index. Perhaps one of the starkest findings of the study was the potential for housing quality to exacerbate ethnic inequalities in health, as there was a four-fold increase in percentage Māori in the lowest quality decile (28%) compared with the highest quality decile (7%).

This study has a few limitations. First, it was an ecological study. As such, one cannot infer causation from the identified associations and one cannot make conclusions about individuals. Second, there is the potential for residual confounding of deprivation. The area-level measure of deprivation used here is only one measure, at the area level. This does not capture differences over the life course of individuals, mis-measurement or other aspects of deprivation. Third, the quality index is not comprehensive nationally and is based on a crude assessment of condition, and so it likely underestimates the range of quality difference from area to area. In addition, this measure relies only on a visual inspection, but it has been strongly correlated with home improvement value (improvement value = capital value – land value) (Telfar Bernard, 2009). Importantly, the measure does not include a number of other aspects of the house and the household environment that are related to health. Rather, this measure serves as an indicator of exposure. Last, this study is cross-sectional and does not consider migration across levels of deprivation or housing quality, nor does it consider the potential lag time in exposure to housing quality and health outcomes.

While the measure of housing quality was simplistic and further research to develop a more sophisticated measure is warranted, the importance of housing quality on health has a number of broader implications. In light of recent earthquakes in Christchurch, consideration of these and similar findings may be useful in residential rebuilding planning efforts. Since the city centre in Christchurch historically was comprised of low-income populations, the provision of high-quality (and affordable) housing could be important to resilience and therefore population health. Another important area for consideration, specific to New Zealand, was the very low percentages of Māori in neighbourhoods of high-quality housing. Due to the detected association between resilience and housing quality, this may be an important area for further research related to ethnicity, housing and...
health inequalities. Māori also tend to have higher rates of household crowding and higher rates of a number of housing-related diseases including asthma, rheumatic fever and skin diseases. Pro-equity policies should consider housing quality improvements targeted at neighbourhoods with high proportions of Māori residents, similar to important work by the Counties Manukau District Health Board and others. These findings also contribute to arguments in New Zealand and beyond for housing ‘warrants of fitness’ or similar publicly available and easily interpretable rating schemes for renters and buyers to assess quality.

In conclusion, it was found that neighbourhood housing quality is associated with neighbourhood resilience (i.e. areas with lower mortality than expected), independent of area-level deprivation. Therefore, improvements in neighbourhood housing quality may bring about concomitant neighbourhood improvements, all of which may boost resilience.

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References


