

Measuring the wellbeing impacts of public policy: social housing

November 2018

Using linked administrative and survey data to evaluate the wellbeing impacts of receiving social housing



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Careful consideration has been given to the privacy, security and confidentiality issues associated with using administrative and survey data in the IDI. Further details can be found in the privacy impact assessment for the IDI available from www.stats.govt.nz.

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Intended audience

This guide is written for analysts and policy people working on social housing related issues and for data scientists and researchers interested in techniques for evaluating policy impact. However we have adopted a plain English style of language to make the guide as accessible as possible.

Working paper

Working papers are intended to stimulate discussion and consideration about policy and research issues. The papers are part of developmental and on-going work, and are not presented as policy documents. The views expressed are not final, and do not necessarily reflect the views of the Social Investment Agency.

Attribution

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Summary

Evidence of the impact of social interventions on the wellbeing of New Zealanders is at the heart of investing for social wellbeing. However, many of the wellbeing outcomes that social interventions target are difficult to measure, and have traditionally been considered only through qualitative evidence or limited proxy measures. Improving the evidence base on the broader wellbeing impacts of social interventions will involve using new analytical techniques and making the best possible use of existing data.

This report presents the first attempt at applying the Social Investment Agency's (SIA's) wellbeing measurement approach to an actual policy issue. This is outlined in the accompanying paper, **Are we making a difference in the lives of New Zealanders – how will we know?** By focusing on the impact of social housing, the report is able to leverage the inclusion of the New Zealand General Social Survey (NZGSS) in the Integrated Data Infrastructure (IDI) to look at how placement in social housing impacts on the wellbeing of people. Understanding the impact of social housing placement on people's wellbeing is fundamental to assessing the effectiveness of social housing interventions.

The method adopted in this paper aims to move beyond a simple descriptive approach, to instead identify the difference in wellbeing outcomes for people before and after being placed in social housing. This is still not as good an estimate of the true causal impact of social housing as a genuine experimental evaluation, but by providing a dynamic picture of the change in wellbeing outcomes associated with a social housing transition, it significantly enriches the available evidence base. The project aims to provide four important pieces of information to assess the impact of social housing interventions. These are:

- What impact does being placed in social housing have on housing outcomes (i.e. the quality of accommodation for social housing recipients – household crowding, temperature of residence, dampness, and the physical state of the house)?
- What impact does being placed in social housing have on other outcome domains important to the recipient's wellbeing (e.g. health, social contact, jobs)?
- What is the impact of placement in social housing on the recipient's overall wellbeing?
- How should we value the gain in recipient's wellbeing for the purposes of cost-benefit analysis?

Beyond this, there are two additional objectives relating to the methodology used. These are:

- Can linked administrative and survey data be used in the IDI to identify the wellbeing outcomes of people before and after a social policy intervention?
- What are the key lessons for using the IDI to assess the impact of policy in wellbeing terms?

Five measures of housing quality were used to examine the impact of social housing. These include three self-report measures from the respondent about the physical state of the house (whether the house is mouldy, whether the house is cold, and whether the house is in poor condition), a subjective judgement from the respondent (their satisfaction with housing) and a derived variable based on the number of bedrooms in the house and the number of people living there (household crowding). These are supplemented by another eleven indicators capturing outcomes relating to

the other domains of wellbeing in the SIA's wellbeing measurement approach and two measures of life satisfaction, capturing the respondent's view of their overall wellbeing.

The main substantive finding to emerge from the analysis relates to the ability to measure wellbeing outcomes at the policy intervention level:

- **It is possible to provide a meaningful picture of the wellbeing impact of a policy intervention across the full range of wellbeing domains.** We were able to produce a picture of how outcomes varied across all twelve wellbeing domains for people placed in social housing, and how these varied before and after being placed in social housing. These results were put together from already existing information in the IDI. The implication of this is crucial: what we can do for social housing we can do for other similar policy interventions where there is a clear break between before and after a person receives the intervention and which affect 20,000 or more people each year.

In addition to the main substantive finding, two more tentative findings that may have relevance for social housing policy are also identified. Given the **experimental nature of this analysis** and data limitations, both findings should be treated with caution:

- **Housing conditions generally improve for people placed into social housing.** Both mould and general housing condition improve with placement in social housing, as does the degree of crowding and levels of satisfaction with housing. However, this does not appear to be the case for whether or not the house is cold. There is no significant difference between the before and after groups in terms of the NZGSS measure of household temperature.
- **Feelings of safety appear to deteriorate when people move into social housing.** Although people's overall wellbeing improves when they move into social housing, perceived safety deteriorates. Interestingly this is not just a short term effect, but also persists in that people living in social housing have lower perceived safety than people in any other housing circumstances.

A key challenge inherent in social policy is how to value different types of outcomes when these have no obvious common metric. One interesting extension of the before/after analysis is to estimate the compensating surplus with placing someone in social housing. The compensating surplus is the amount that you would have to pay a person so that they were indifferent between receiving a service (e.g. social housing) and not receiving the service but having the extra money. Using the compensating surplus we can compare the benefits of different kinds of service (e.g. social housing and a hip operation): the service with the higher compensating surplus has a larger impact on the wellbeing of recipients.

To estimate the compensating surplus we use life satisfaction – a measure of a person's overall assessment of their life as a whole – as a common metric for evaluating the impact of different policies. This approach to valuing non-market outcomes is increasingly used by economists since there is good evidence that it produces meaningful results (Clark and Oswald, 2002; Fujiwara, 2013a, H.M. Treasury, 2013; OECD, 2013) and because it is relatively easy and inexpensive compared to alternatives.

- **The middle estimate of the annual value associated with the provision of social housing for an individual person was \$7,699 with sensitivity tests giving a range from \$4,624 through to \$12,818 depending on the assumptions used.** This is telling us that the average successful

social housing recipient would be indifferent between being placed in a social house and retaining their current income or not being placed but receiving an increase to their annual income of \$7,699.

Although the picture that emerges from this analysis of the impact of social housing on wellbeing is both interesting and plausible, is important to be clear about the purpose and the limitations of the research. **The purpose of the research is primarily to apply the SIA's wellbeing measurement approach to a real policy issue**, rather than looking for actionable insights at this stage. Knowing about the main limitations informs decisions about how much weight to give these findings as opposed to prior beliefs and the results of other research. It also sets the direction for future research by helping to identify areas where further work would significantly improve the accuracy and reliability of estimates of the effect of social housing on peoples' wellbeing.

There are four main limitations associated with the data and methodology used in this research. While none of these mean that the results are necessarily wrong, all deserve to be taken seriously. These are:

- Wellbeing impacts are for **before and after, not control and treatment** – we don't have a strong counterfactual
- There is a **bias in the sample of people we can observe in the NZGSS** – people who need social housing are often harder to find before they are in social housing than afterwards
- The **sample size is small** – the number of people placed in an HNZ house who are also interviewed in the NZGSS in the same year is small
- The **time frame is limited** – we do not observe long term effects.

Although it is tempting to regard the substantive findings as the most important outcome from this analysis, this would be misleading. As a proof of concept, one of the key goals for the work on social housing and wellbeing has been to establish what can be done by using social survey data in the IDI. In doing so a number of key lessons were learned. The most important of these are that:

- **Survey and administrative data are complements not substitutes in the IDI.** Survey data can capture concepts that simply will never likely to be reflected by administrative records (e.g. life satisfaction) and can provide measures of outcomes (e.g. was the house cold?) rather than the service delivered (e.g. was the person in social housing?). Both features make survey data especially valuable in evaluating the effectiveness of social policy interventions (where it is difficult to obtain good outcome measures from service usage).
- **The NZGSS is particularly valuable because most of the data it obtains has no direct equivalent in the IDI.** The NZGSS focuses heavily on social outcomes that are not reflected in administrative datasets. Information on people's subjective mental states, social connections, levels of trust or sense of safety are currently not possible to obtain from administrative data, and in many cases will never be obtainable from these sources. However, measures of this type are of immense analytical value in evaluating social policy interventions.
- **Survey data could be designed to take advantage of the IDI much better.** Linking into the IDI all people identified in the household questionnaire would give the ability to create household level variables for analysis from administrative data. The sample size for the NZGSS should be increased with annual waves of approximately 20,000. This would represent a four to five fold increase in sample size, and would allow a much more robust analysis of the wellbeing

outcomes of social programmes. It is worth noting that, although a larger sample size would be associated with significant cost increases, there would be some scope to partially offset this by eliminating variables that duplicate existing IDI measures.

Discussion

Introduction

Investing for social wellbeing means ensuring people get the support they need to live the lives to which they aspire. But how can we tell if the social services and interventions we fund and deliver are actually improving the lives of the New Zealanders they are designed to help? SIA is working to support the social system to be able to do that. We have developed an approach to measuring the wellbeing impacts of specific social interventions, to add to the evidence we already have available to inform the trade-offs that need to be made.

Evidence of the impact of social interventions on the wellbeing of New Zealanders is at the heart of investing for social wellbeing. However, many of the wellbeing outcomes that social interventions target are difficult to measure, and have traditionally been considered only through qualitative evidence or limited proxy measures. Improving the evidence base on the broader wellbeing impacts of social interventions will involve using new analytical techniques and making the best possible use of existing data.

One area of current policy interest in New Zealand is the issue of social housing. While the provision of social housing is one of the larger social sector interventions by central government, the available information on the impact of social housing on the wellbeing of recipients is relatively limited. This informed the SIA's 2016 work in developing a *Social Housing Test Case* that focused on the net fiscal impact of placement in social housing. However, the fiscal impact of social housing is not a full measure of the net benefit of the intervention as it captures only the costs and omits the impact on the wellbeing of recipients.

This paper complements the *Social Housing Test Case* (Social Investment Unit, 2017) by applying the SIA's wellbeing measurement approach (outlined in the accompanying paper, **Are we making a difference in the lives of New Zealanders – how will we know?**) to the case of social housing in order to provide information on the wellbeing outcomes of social housing recipients. In particular, the project aims to provide four key pieces of information to assess the impact of social housing interventions. These are:

- What impact does being placed in social housing have on housing outcomes (i.e. the quality of accommodation for social housing recipients – household crowding, temperature of residence, dampness, and the physical state of the house)?
- What impact does being placed in social housing have on other outcome domains important to the recipient's wellbeing (e.g. health, social contact, and jobs)?
- What is the impact of placement in social housing on the recipient's overall wellbeing?
- How should we value the gain in recipient's wellbeing for the purposes of cost-benefit analysis?

Beyond this, a key objective of the paper is to test the underlying methodology used to identify the wellbeing outcomes of people before and after a social policy intervention and identify any lessons from this for using the IDI to assess the impact of policy in wellbeing terms.

Background

While much of the early work of the SIA has focused on estimating the forward fiscal liability associated with different populations and interventions, this is not the primary intent of investing for social wellbeing. To evaluate whether a particular intervention works it is necessary to understand what constitutes a good outcome. Cost information alone does not provide information on whether benefits exceed costs, and looking at costs to government alone, does not provide us with enough information. We are looking at new ways to make more systematic use of data, analytics and evidence, and draw on frontline knowledge and people's lived experience to create a better foundation for decision making. This paper considers one component of that – evidence on wellbeing.

With relatively high levels of immigration, significant pressure on the building industry due to recent earthquakes, a long term trend towards larger houses for a given family size, and a high level of speculative demand for houses, New Zealand faces increasing challenges in housing all of its population adequately. House prices in New Zealand are currently among the highest in the world relative to incomes, and New Zealand is reported to have the highest rate of homelessness in the OECD (OECD, 2017a).

In this environment, one of the main policy levers available to influence housing outcomes for low income families is the provision of social housing. However, the impact of providing social housing on the outcomes experienced by low income families is not well understood. While the SIA has completed substantial analysis of the fiscal impacts of placing a family in social housing through the *Social Housing Test Case*, less is understood about how being placed in social housing affects the wellbeing of families. Given that social housing is costly compared to other forms of housing support – such as the accommodation supplement – it is important to understand how the outcomes for social housing recipients compare to the outcomes for those who receive other forms of support.

The Social Housing Test Case

The Social Housing Test Case was a research project undertaken by the SIA in 2016 aiming to understand whether it was possible to calculate a fiscal return on any given investment within the social sector. While the Test Case focused specifically on fiscal outcomes, this was viewed as the first step in a broader programme of work aiming to understand where most of the costs and benefits of living in a social house accrue across government, and to help prioritise social spending decisions by understanding the impact on outcomes for different groups of people.

A propensity matching approach was used to create two cohorts of people from existing data that aimed to be comparable in all ways except for the receipt of a social house. The difference in fiscal spending between the two cohorts across different government agencies was then used to examine the outcomes of placement in social housing. Although the project was successful in identifying the change in government spending associated with placement in social housing for different government agencies, it was concluded that the results were not meaningful in terms of evaluating the effectiveness of social interventions. For example, it was shown that being placed in a social house was associated, on average, with higher future education spending on the part of government. However, whether this represents a good outcome or not depends on what is driving the expenditure. If the higher expenditure reflected better school attendance from children placed

in social housing this would clearly be a good outcome, but if it reflected increased need from children whose social networks have been disrupted by placement in social housing the higher spending could reflect poor outcomes.

The Social Housing Test Case explicitly noted limitations associated with the methodology used for evaluating the impact of social housing and recommended further work to go beyond the fiscal impacts. In particular, it was noted that the SIA:

is also developing a methodology for including the impact of a service on wider economic and wellbeing indicators, as well as fiscal. This will provide a stronger sense of the overall impact of a service on individuals, and would create more nuanced and person-centric information to inform analysis and decision-making.

Applying a social wellbeing measure to housing

This report represents the next steps from the Social Housing Test Case and a first attempt at applying the SIA's wellbeing measurement approach to an actual policy issue. By focusing on the impact of social housing the report is able to build on the foundations developed for the *Social Housing Test Case*. However, this report leverages off the inclusion of the New Zealand General Social Survey (NZGSS) in the IDI in June 2017 to go beyond fiscal liability to look at how placement in social housing impacts on the wellbeing of people. Understanding the impact of social housing placement on people's wellbeing is fundamental to assessing the effectiveness of social housing interventions. However, wellbeing is inherently multi-dimensional, and assessing the wellbeing impact of a policy necessarily involves looking across a range of different types of outcome.

The SIA wellbeing measurement approach guided us as to the range of different aspects of a person's life that will need to be considered in evaluating the impact of an intervention on wellbeing. Figure 1 below illustrates the scope of the approach. Dimensions of wellbeing are grouped in three broad areas:

- the individual's subjective view of their overall wellbeing,
- non-market outcomes that capture aspects of quality of life for which there is no market, and
- market outcomes capturing dimensions of wellbeing for which there are market prices.

The approach draws heavily on both international practice – such as the OECD *How's Life?* report – and New Zealand evidence on what matters to people. It is also consistent with the Treasury's Living Standards Framework and with Statistics New Zealand's framework for measuring New Zealand's progress.

Figure 1. The Domains of Wellbeing



In evaluating the impact of providing social housing to people, we would ideally like to know the causal impact of providing social housing to someone in need on each of the outcome domains set out in figure 1. In practice, there are challenges both in identifying the causal effect of social housing (because it is difficult to establish exactly what would have happened to people in the absence of providing social housing), and challenges in measuring many of the outcomes. In particular, most of the data on individuals in the IDI refers to the provision of government services rather than wellbeing outcomes.

The inclusion of the NZGSS in the IDI represents a step change in the ability to use the IDI to examine the impact of government services on people’s wellbeing. From the perspective of social housing the most valuable information in the NZGSS are measures of housing quality and crowding, as well as overall satisfaction with life.

Scope and limitations

The focus of the project is on people placed in social housing – specifically Housing New Zealand (HNZ) clients – and the project does not attempt to assess the effectiveness of other housing

interventions, except to the extent that people in other circumstances form the baseline for assessing the impact of social housing provision. No attempt is made in the project to investigate the cost of providing social housing or the flow-on effects of social housing to people other than the recipients. While both of these issues are of high importance in assessing the overall effectiveness of social housing interventions, the focus of this project is complementing existing information on the costs of providing social housing (i.e. the *Social Housing Test Case*) with information on what the intervention achieves in terms of wellbeing changes for recipients of social housing.

The scope of outcomes considered for people placed in social housing focuses primarily on outcomes related to housing quality, but changes in other outcomes important to peoples' wellbeing are also considered where information is available.

A key challenge in the analysis has been that the information on social outcomes used here derives from survey data. This limits the size of the sample that can be used for analysis to people placed in an HNZ house **and** covered by the NZGSS.

Data and method

Overview

In evaluating the impact of a social sector intervention we would ideally be able to observe the causal effect of providing the intervention on the wellbeing of the relevant individuals, with a particular focus on the wellbeing outcomes that are the primary focus of the intervention. In the case of social housing, we would like to know the causal effect of providing social housing on the characteristics of housing that people live in, their overall life satisfaction, and other wellbeing outcomes including health, safety, employment, and living standards. However, identifying a causal impact is difficult, since it requires not only a measure of the wellbeing outcomes for people receiving the intervention, but also a counterfactual capturing the wellbeing outcomes of people who did not receive the intervention.

For many government interventions, it is not possible to obtain a good estimate of the causal impact of the intervention on outcomes for recipients. We often lack good data on wellbeing outcomes and the available data does not allow us to establish a strong counterfactual outcome. It is not possible to run a randomised controlled experiment on the provision of many government services. For this reason, the evidence available to inform policy advice is often little more than figures on service usage and average wellbeing measures for different population groups.

The method adopted in this paper aims to move beyond a simple descriptive approach, to identify the difference in wellbeing outcomes for people before and after being placed in social housing. This is still not as good an estimate of the true causal impact of social housing as a genuine experimental evaluation, but by providing a dynamic picture of the change in wellbeing outcomes associated with a social housing transition, it significantly enriches the available evidence base.

To obtain information on the changes in wellbeing associated with a social housing transition, two main datasets are used.

- The first of these is the Housing New Zealand (HNZ) Social Housing Dataset in the IDI that captures register information on applications for and placement in HNZ social housing.
- The second main source of data is the four waves of the NZGSS included in the IDI (2008, 2010, 2012, and 2014). This is the primary source of information on wellbeing outcomes for individuals.

In addition to the two main data sources, MSD data in the IDI is used, in conjunction with the address register, to identify households in receipt of the accommodation supplement. Customs data is also used to provide information on spells overseas.

The analytical approach adopted here involves three stages. The first stage is a simple descriptive overview of wellbeing outcomes by housing tenure. This draws on wellbeing measures in the NZGSS, MSD data on benefit payments from the IDI to distinguish people living in households receiving the accommodation supplement from those receiving no government housing support, and the NZGSS to identify people in HNZ social housing, private rentals, or their own home. The descriptive analysis allows us to look at average wellbeing outcomes for people living in different types of housing arrangements.

A descriptive approach provides relatively little information about the impact of social housing because people receiving social housing differ systematically from the rest of the population: HNZ prioritises social housing applications based on need. To address this, the second stage of the analysis leverages information in the IDI and the NZGSS to obtain measures of wellbeing outcomes for social housing applicants before and after being placed in a social house.

Using the HNZ social housing dataset we obtained a sample of successful social housing applications. We then matched all the people attached to these successful applications to the NZGSS to identify those who were interviewed for the NZGSS within a window spanning 15 months before to 12 months after their placement in a HNZ house. Although the NZGSS is a cross-sectional survey, interviewing takes place over a 12 month period so that, having made an application, whether the applicant is interviewed before or after they are placed in a house is essentially random. Because all applicants in the original sample were successful (i.e. the HNZ sample is restricted to applicants who did go on to be placed in a social house), we can interpret differences in the results for before and after interviews as representative of the situation of people before and after being placed in HNZ social housing.

It is important to note that we cannot interpret the transition into social housing as causing any difference in outcomes between these two groups without making some assumptions about what would have occurred in terms of counterfactual wellbeing outcomes if the individual had not been placed in a HNZ house. However, even the observations of what happened before and after the transition represent a significant improvement on straight cross-sectional descriptions of wellbeing outcomes for people in different housing situations and, combined with other information, improves the evidence available to policy makers in important ways.

The third part of the analysis builds on the second stage by examining the potential impact of two sources of bias on the estimated transition effects. First, we draw on results from the whole NZGSS to estimate whether there is a “positivity bias” associated with moving into a new house (regardless of whether that house is a HNZ house or any other house). This purpose is to determine whether moving into **any** new house is associated with a significantly higher level of life

satisfaction around the period of the move. This is distinct from any long-term gain in wellbeing associated with moving to a **better** house.

Another potential source of bias may arise because it is easier to locate and therefore interview people for the NZGSS after they have been placed in a HNZ house than before. We test whether the differences in outcomes between the before and after groups identified in the second stage of the analysis remain significant after controlling for any differences in the demographic characteristics of the before and after groups.

The HNZ Social Housing Dataset

The HNZ Social Housing Dataset is one of the two main sources of data used in this analysis. The dataset is drawn from HNZ transaction records, and captures information on applications, tenancies (i.e., placement in social housing), and exits from tenancies. While some information – such as monthly records of tenanted households – is captured only at the household level, tenancy applications and placements can be linked to all of the individuals associated with the application, not just the primary applicant. Information on applications and exits is time stamped, so it is possible to identify the dates at when an application is made and when people are placed in a house at the start of a new tenancy.

Complete data exists for all HNZ tenancies from 2001 to 2015. However, we are interested only in records we can connect to the NZGSS, which was collected from 2008 onwards. For this reason, we make use of HNZ social housing data from April 2007 through to June 2015. Table 1 below provides basic descriptive statistics for the HNZ Social Housing Dataset from 2007 through to 2015. The first two columns report the number of applications and placements, while the second two columns give the number of individuals associated with these. The total number of people involved is several times the number of applications because applications are made at the household level and typically involve a family of several people.

Table 1. Descriptive statistics for the HNZC Housing Tables

Year	Applications	Applications resulting in placement in social housing	Total people associated with applications	Total people placed in social housing
2007	16,248	9,549	43,215	38,454
2008	16,029	9,423	43,068	37,467
2009	15,630	9,012	41,697	34,584
2010	13,719	8,193	36,534	31,431
2011	10,695	7,980	29,964	31,227
2012	7,818	6,285	22,605	22,086
2013	9,492	8,358	25,767	25,302
2014	11,724	7,263	30,573	21,087
2015	5,025	4,590	12,561	12,714

Source: HNZ Social Housing Database, IDI

Over the period from 2007 to 2015 there was a gradual downward trend in the number of applications and placements, and a broadly similar fall in the number of people placed. This may partly reflect a decrease in the size of the stock of social housing managed by HNZ, but may also be influenced by turnover rates in social housing and the average length of tenancy. In the case of 2015 the numbers are low because the available data finishes in the middle of the year.

The NZGSS

The second dataset used in this analysis is the NZGSS. This is a household survey carried out by Statistics New Zealand and is intended to collect information on the wellbeing of the New Zealand population. The survey includes both a household questionnaire, which obtains relatively limited socio-demographic information on the whole household, and a personal questionnaire, which collects much more detailed information on the wellbeing of the respondent across a wide range of different domains.

Each wave of the NZGSS covers approximately 8,500 households. As only one person in each household responds to the personal questionnaire, there are also approximately 8,500 responses to the personal questionnaire in each wave. The NZGSS is collected every 2 years, starting in 2008. Table 2 below gives the response rate and achieved sample size for each wave of the NZGSS from 2008 to 2014, as well as the proportion of personal responses that could be linked to the IDI spine and the resulting sample available in the IDI. The IDI spine is the dataset containing information for all people in New Zealand that is used to link administrative and survey data together for anonymised research and analysis.

Table 2. Descriptive statistics for the NZGSS

NZGSS wave	Response rate	Achieved sample	Link rate to IDI	IDI sample
2008	83%	8,721	82%	7,176
2010	81%	8,550	81%	6,942
2012	78%	8,462	81%	6,861
2014	80%	8,795	77%	6,780

Source: NZGSS 2008-2014

The response rate in table 2 gives the proportion of eligible respondents contacted by Statistics New Zealand who completed the NZGSS. At 78% to 83%, the NZGSS has a relatively high response rate compared to many other Statistics New Zealand household surveys such as the Household Labour Force Survey. When the NZGSS is added to the IDI, however, it is necessary to link every respondent in the NZGSS to a record in the IDI spine. This is done on the basis of a range of different criteria including name, date of birth, and sex, and is usually sufficient to identify the relevant person. In some cases though, there may be issues with the data (e.g. the date of birth is transposed in one dataset or a person changes their name) and it is not possible to find a link between the NZGSS record and the spine. This is responsible for the fact that the link rate between the NZGSS and the IDI is less than perfect (77% to 82%), giving a total IDI sample for the NZGSS of between 6,861 and 7,176 respondents.

Outcome measures

The main value of the NZGSS in the context of looking at the impact of social housing is that the NZGSS contains a wide range of outcome measures relevant to wellbeing. Although originally structured around the outcome domains contained in *The Social Report* (MSD, 2001 – 2016), these measures are also well aligned with the SIA wellbeing measurement approach. In fact, the SIA wellbeing measurement approach and the *Social Report* framework are largely consistent. This means that it is possible to find measures in the NZGSS that can serve as indicators of most of the wellbeing domains in the SIA's approach.

Table 3 below lists the indicators used in this report to measure the wellbeing of people living in social housing. The first column identifies the domain of wellbeing that the indicator relates to, while the second column describes the indicator itself. Columns three to five give the value of the indicator for the New Zealand population as a whole as well as the 95% confidence level for the estimate. For most indicators the value is the proportion of the New Zealand population aged 15 or older and living in private households who report experiencing the outcome in question averaged across the first four waves of the NZGSS. For example, 9% of the population report that their house is mouldy. For two indicators (mental health and physical health) the value is the mean score for the population on a 0 to 100 scale. Life satisfaction is reported two ways: both the proportion of the population reporting low life satisfaction (a score of 1 to 3 on a 5 point scale) and the mean score for the population.

Table 3. Outcome measures

Dimension of wellbeing	Indicator	Value	Lower bound	Upper bound
Subjective wellbeing	Low life satisfaction	12.9%	12.4%	13.4%
Subjective wellbeing	Mean life satisfaction score	4.1	4.1	4.1
Housing	House is mouldy	9.0%	8.5%	9.4%
Housing	House is cold	17.1%	16.5%	17.7%
Housing	House is in poor condition*	6.3%	5.9%	6.8%
Housing	House is crowded	7.0%	6.5%	7.5%
Housing	Dissatisfied with housing*	14.0%	13.4%	14.6%
Safety	Feels unsafe walking alone at night	43.9%	43.1%	44.6%
Jobs and earnings	Unemployed	4.0%	3.6%	4.3%
Social connectedness	Lonely	15.3%	14.7%	15.8%
Income and living standards	Material deprivation	18.0%	17.3%	18.8%
Civic engagement and governance	Did not vote	19.5%	18.7%	20.2%
Ukaipotanga / cultural identity	Unable to express culture	15.4%	14.9%	16.0%
Health	Mental health SF12 mean score	50.6	50.4	50.7
Health	Physical health SF12 mean score	50.2	50.1	50.3
Knowledge and skills	No qualification	19.3%	18.6%	19.9%
Environmental quality	Unable to easily access natural spaces	5.7%	5.3%	6.2%
Leisure and free time	Not enough free time	43.6%	42.7%	44.4%

Source: NZGSS 2008-2014; * NZGSS 2008-2012

Because the values presented in table 3 are the average across all four waves of the NZGSS from 2008 to 2012, they should not be taken to be representative of the situation in New Zealand at a particular point in time. Instead, they are presented as a reference point for comparisons with the before and after groups discussed below. Pooling waves from the NZGSS also raises a second issue in that there is a significant change in the NZGSS questionnaire between 2012 and 2014. While not affecting all of the indicators listed in table 3, a number were subject to changes in question wording. In some cases these changes were relatively limited and reflect minor amendments to the wording or response scale. In these instances a concordance was developed to map responses from 2014 onto those from 2008-2012. Annex 1 provides details of the relevant changes. In a

smaller number of cases, where the 2014 questionnaire simply lacked an equivalent measure to the 2008-2012 surveys (housing condition, housing satisfaction), analysis was conducted on the basis of the 2008-2012 data only at the price of a reduced sample size for comparisons involving that variable.

Before and after groups

The before and after groups capture the average position of people who have applied for and been placed into HNZ social housing in the 15 months prior to their placement in a house and in the 12 months afterwards respectively. A 15 month window for the before group was adopted after it became clear that the sample size for the before group was likely to be substantially less than for the after group.

Table 4 below provides a descriptive breakdown of the before and after groups. In principle, the before group should be about 25% larger than the after group in that there is no obvious reason why more people should be interviewed before or after moving house, and the window for the before group is 15 rather than 12 months. It is obvious, however, that this is not the case. The after group is nearly twice the size of the before group, with 84 observations compared to only 48 for the before group.

Table 4. Descriptive statistics for treatment and control groups

Variable	Before	After
NZGSS 2008	21	27
NZGSS 2010	9	12
NZGSS 2012	12	24
NZGSS 2014	6	21
1 adult	21	54
2 adults	21	24
3+ adults	6	6
Female	30	51
Male	18	33
15-24yrs	12	21
25-39yrs	27	33
40+yrs	9	30
European	18	36
Māori	18	36
Pacific	12	21
Total	48	84
Mean time between interview and placement in house	247 days	196 days

Source: NZGSS 2008-2014, HNZ Social Housing dataset

In addition to differences in size between the before and after groups, the two samples differ quite substantially in composition. The before group is much more likely to be from the 2008 wave of the NZGSS, to come from a two adult household, and to be aged between 25 and 39 years.

Given the method adopted for selecting the before and after groups, the two groups should have been very similar in composition and of roughly similar sizes after allowing for the differing sample window. The primary cause of the difference in sample size and composition appears to be due to a difference in the probability of being interviewed in the NZGSS before and after being placed in social housing. In particular, there is a clear rise in the probability of being interviewed in the NZGSS after being placed in social housing rather than beforehand. This finding is intuitively plausible, as to be interviewed in the NZGSS a person needs to be living in a permanent residence, and one of the main criteria for obtaining social housing is that a person currently does **not** have a permanent residence.

The differences in composition between the before and after groups raises a significant methodological challenge for the analysis of wellbeing outcomes: differences in the composition of the before and after population will lead to differences in average wellbeing outcomes between the two groups that are not a consequence of the change in accommodation status. The consequences of this for the analysis are discussed later in the section on **adjusting for response bias** and on **limitations**.

Results

Social housing is a policy intervention that is aimed first and foremost at improving housing outcomes. While a core part of the rationale for doing so is that better housing outcomes will contribute to better outcomes in other areas of wellbeing, the centrality of housing quality to evaluating the impact of social housing cannot be avoided. For this reason, the results reported here are broken into two main sections. The first section focuses exclusively on the impact of social housing on the housing dimension of wellbeing. This covers the physical characteristics of the house, as well as crowding and overall satisfaction with housing. Going beyond housing, the second part focuses on the wider wellbeing impact of being placed in social housing. This looks at how the wellbeing indicators identified in table 3 vary between the before and after groups.

After considering the differences between the before and after groups, the third part of the results section looks at adjustments for response bias. This part of the report investigates the degree to which the imbalance in composition between the before and after groups produces a significant bias in the main findings. Finally, an estimate of the compensating surplus¹ associated with being placed in social housing is estimated using information on the difference in life satisfaction between the before and after groups. This provides the basis for comparisons of the total impact of being placed in social housing to other government interventions and provides a common metric to establish which intervention has a larger overall impact on a person's wellbeing.

¹ The compensating surplus for being placed in social housing is the amount of money required to make a person indifferent to receiving social housing or receiving a cash payment.

Housing quality and social housing

Five measures of housing quality were used to examine the impact of social housing. These include three self-report measures from the respondent about the physical state of the house (whether the house is mouldy, whether the house is cold, and whether the house is in poor condition), a subjective judgement from the respondent (their satisfaction with housing) and a derived variable based on the number of bedrooms in the house and the number of people living there (household crowding). In the analysis that follows, each outcome is reported as the proportion of respondents experiencing a poor outcome for that indicator. Table 5 below presents the proportion of the population experiencing poor housing outcomes by different accommodation circumstances. The results here do not capture the effect of a change in housing status (e.g. moving into social housing) but simply provide the average housing outcomes for people in each type of accommodation.

Table 5. Differences in housing quality and accommodation type

Indicator	Accommodation Supplement-Renting	Social Housing (Income related rent)	Non Subsidised-Own Home	Non Subsidised-Renting
House is mouldy	22%	27%	5%	16%
House is cold	33%	43%	12%	25%
House in poor condition*	16%	16%	4%	9%
House is crowded	18%	31%	3%	10%
Dissatisfied with housing*	29%	34%	9%	23%

Source: NZGSS 2008-2014; * NZGSS 2008-2012

Note that household crowding is a derived variable based on household size and the number of bedrooms in the dwelling, while all other variables are respondent self-reports.

It is evident from table 5, and unsurprising, that people not in need of housing assistance have better housing outcomes than those in receipt of assistance. People owning their own homes have the lowest rates of poor outcomes across all five indicators followed by those living in non-subsidized rental accommodation. Only 9% of people living in their own home are dissatisfied with their housing, and the prevalence of mould, crowding or a house in poor condition is below 5%. Renters have a higher prevalence of housing problems, with 16% reporting mould, 9% a house in poor condition, and 25% a cold house.

People in receipt of housing assistance report consistently higher rates of housing problems than those not receiving assistance. However, people living in social housing have worse outcomes than those renting from a private landlord but receiving accommodation supplement. While 16% of both people in receipt of the accommodation supplement and of those in social housing report that the house is in poor condition, rates of cold (43% to 33%), and crowding (31% to 18%) are significantly higher for those in social housing. This is reflected in overall levels of dissatisfaction with housing, which are also higher (34% to 29%) for those in social housing.

The picture that emerges from table 5 is striking in the degree to which housing outcomes are worse for those in social housing than for any other group. Does this mean that we should regard social housing as a failure in terms of its core goal of providing good quality housing to those in

need? This question is addressed in table 6. Where table 5 looks at the average outcomes for those living in social housing compared to other forms of accommodation, it does not capture the impact of placing someone in social housing. People who end up in social housing differ systematically from other groups, including those in receipt of the accommodation supplement.

Table 6 presents average outcomes for the same five housing indicators as table 5, but looks at those indicators for people before and after they are placed in social housing. The picture that emerges here is very different than the more descriptive analysis in table 5. The proportion of people living in a mouldy or crowded house falls significantly for people after they are placed in social housing compared to the situation in which they lived beforehand. Only 10.7% of the after group report living in a mouldy house compared to 25% of the before group, while the rate of crowding is only 10.7% for the after group compared to 31.3% before. Similarly, the house is less likely to be in poor condition for the after group compared to the before group (less than 10% compared to 28.6%) and the after group is less likely to report dissatisfaction with their housing (23.8% compared to 42.9%). The only housing outcome for which there was no significant improvement associated with moving into social housing was whether the house is cold.

Table 6. Placement in social housing and housing quality

	Before	After	t-statistic	degrees of freedom	p-value
House is mouldy	25.0%	10.7%	-2.037	73.461	0.045
House is cold	43.8%	35.7%	-0.633	94.807	0.528
House is in poor condition*	28.6%	<10%	-3.218	48.173	0.002
House is crowded	31.3%	10.7%	-2.282	72.150	0.025
Dissatisfied with housing*	42.9%	23.8%	2.045	74.986	0.044

Source: NZGSS 2008,-2014, HNZ Social Housing dataset; * NZGSS 2008-2012, HNZ Social Housing dataset

Note that household crowding is a derived variable based on household size and the number of bedrooms in the dwelling, while all other variables are respondent self-reports.

The contrast between the descriptive picture in table 5 and the before/after comparison in table 6 is unsurprising. Social housing is assigned to those in greatest need (with some allowance based on the suitability of the available housing to the applicants). This means that, even if the quality of social housing is not of the same average standard as that for non-subsidised renters, there is still significant scope for it to represent an important improvement on the housing situation of those receiving a place. However, the comparison also raises some puzzles. In particular, the after group in table 6 has only 10.7% of the population reporting mould compared to 27% of the total population living in social housing in table 5. Similarly, 31% of people in social housing live in crowded accommodation (table 5), but only 10.7% of people moving into social housing find themselves living in crowded accommodation (table 6).

An investigation of the underlying data suggests that in both cases the difference is due to two main factors. First, outcomes change over time. People moving into social housing are initially provided with housing that is suitable for their household size, but household size continues to grow over time. Similarly, houses which are not mouldy when people move into them become mouldy over time. This analysis is described in more detail in annex 5. In addition, the definition of social housing used in table 5 is derived from self-reports in the NZGSS, while table 6 uses HNZ

data to identify people in social housing. This likely results in an upward bias in the proportion of people in social housing reporting poor outcomes in the NZGSS as people in poorer quality houses may be more likely to self-report that they are living in social housing.

Wider wellbeing impacts of social housing

Obviously the primary wellbeing outcomes at which social housing policy is aimed are those related to improving the quality of housing that people experience. However, it is interesting to look at how placement in social housing affects other dimensions of wellbeing. These outcomes matter both because it might be hoped that there are positive spillovers from social housing to other dimensions of wellbeing, and because it is important to know whether there are any unanticipated consequences associated with being placed in social housing. Table 7 below provides a descriptive overview of wellbeing outcomes other than housing for people in different accommodation circumstances.

Table 7. Differences in non-housing wellbeing outcomes and accommodation type

Indicator	Accommodation Supplement-Renting	Social Housing	Non Subsidised-Own Home	Non Subsidised-Renting
Low life satisfaction	30.4%	23.4%	9.5%	14.5%
Material deprivation (bottom 20%)	59.5%	58.8%	9.6%	24.1%
Unemployed	13.7%	12.7%	2.3%	3.8%
Feel lonely or isolated	29.1%	21.0%	11.9%	19.1%
Feel unsafe walking at night	51.2%	59.7%	42.5%	41.6%
Did not vote last election*	33.6%	19.6%	13.1%	35.8%
Unable to express cultural identity	24.8%	21.5%	13.1%	18.3%
Mental health SF12 mean score	44.9	47.3	51.6	50.2
Physical health SF12 mean score	49.5	47.2	50.1	52.0
No qualifications	29.6%	41.4%	18.1%	14.3%
Unable to access natural spaces	s	17.5%	4.1%	7.4%
Not enough free time	44.5%	30.9%	44.0%	44.9%

Source: NZGSS 2008-2014; * NZGSS 2008-2012

As is the case for housing outcomes, home owners generally do better than people in other circumstances. However, the gap is narrow between home owners and non-subsidised renters than is the case with only housing outcomes. For a number of dimensions of wellbeing such as health and perceived safety, the gap between home owners and renters is very narrow. People in receipt of housing assistance (either the accommodation supplement or social housing) are noticeably worse off than those not in receipt of assistance across almost all dimensions of wellbeing. The only noticeable exception is voting participation, where people living in social housing were less likely not to vote (19.6%) than both people living in housing subsidised through the accommodation supplement (33.6%) and non-subsidised renters (35.8%), and free time where people in social housing were less likely (30.9%) to report not having enough free time than all other groups. There are fewer differences between the population living in houses subsidised through the accommodation supplement and those in social housing. People in social housing are less likely to have low life satisfaction and have higher mental health scores, but the accommodation supplement is associated with a lower risk of feeling unsafe at night, a lower probability of having no qualifications, and better physical health.

The ambiguous picture presented in table 7 is, with two exceptions repeated in table 8, which looks at wider wellbeing outcomes before and after placement in social housing. Across most of the wellbeing outcomes measured there is no significant difference between the before and after populations. In the case of many outcomes this is not surprising. It is difficult to imagine how placement in social housing could have a large impact on a person's qualifications, particularly given that the after group captures the position of people at an average of 196 days after placement. The fact that the after group captures a snap shot of the position roughly six months after placement in social housing also probably accounts for the lack of any observed change in outcomes that housing quality is known to affect, such as health status (Keall et al, 2009).

Table 8. Placement in social housing and non-housing wellbeing outcomes

Indicator	Before	After	t-statistic	degrees of freedom	p-value
Low life satisfaction	43.8%	25.0%	1.958	88.052	0.053
Material deprivation (bottom 20%)	73.3%	77.8%	-0.547	85.998	0.586
Unemployed	s.	14.3%	1.044	116.249	0.299
Feel lonely or isolated	25.0%	32.1%	1.069	105.278	0.288
Feel unsafe walking at night	50.0%	67.9%	-1.962	91.769	0.053
Did not vote last election*	56.3%	57.1%	0.385	97.973	0.701
Unable to express cultural identity	18.8%	25.0%	-0.412	98.301	0.681
SF12 physical health	49.3	47.6	-0.870	104.099	0.386
SF12 mental health	46.2	43.5	-1.021	93.514	0.310
No qualification	43.8%	42.9%	0.280	97.554	0.780
Unable to access natural spaces	18.8%	18.6%	-0.021	96.709	0.984
Not enough free time	45.8%	26.7%	-2.191	87.729	0.031

Source: NZGSS 2008,-2014, HNZ Social Housing dataset; * NZGSS 2008-2012, HNZ Social Housing dataset

However, in addition to the wellbeing outcomes for which there is no change, there are two dimensions of wellbeing that show a comparatively large change, and which are extremely close to being significant at the 95 per cent level and one outcome that is significant at the 95 per cent level. The risk of low life satisfaction and whether the respondent feels unsafe walking at night both have a p-value of 0.053 indicating that they are very close to significant². Not having enough free time has a p-value of 0.031, indicating a significant difference between the before and after groups.

Life satisfaction measures provide information on a person's overall assessment of their life, so a fall in the proportion of the population experiencing low life satisfaction would suggest that social housing interventions improve the overall wellbeing for recipients. The proportion of people in the after group reporting low life satisfaction is much lower than is the case for the before group (25% compared to 43.8%). As discussed above this result is significant at 90% and only just fails being significant at 95%.

² Improvement in risk of low life satisfaction and deterioration in whether the respondent feel unsafe at night fall just below the standard threshold for accepting an affect is statistically significant. However, they are so close to the cut-off that a formal statistical test for whether the difference between the before and after groups is significantly different from zero in both cases is significant at the 5 per cent level. For this reason they are explored further in the main body of this report.

The impact of placement in social housing on feelings of safety is less positive. A higher proportion of people in the after group report feeling unsafe walking in their neighbourhood at night than do people in the before group (67.9% compared to 50%). In other words, being placed in social housing makes people feel less safe. As with life satisfaction, this result is significant at 90% and only just misses out being significant at the 95% level. Although this result is unexpected, it is not implausible. Being placed in social housing typically involves moving to a new neighbourhood where other deprived households are concentrated. Both the new neighbourhood and the socio-economic make-up of the neighbourhood could both plausibly contribute to feelings of insecurity.

Finally, there is a large fall in the proportion of people reporting that they do not have enough free time from 45.8% before placement to 26.7% afterwards – i.e. people feel that they have more free time after being placed in a social house. This result is plausible, but of less interest than the other results. People actively searching for secure housing are likely to have less free time than those who have secure housing. To a large degree the before/after gap is therefore likely to represent simply the process of searching for and being placed in accommodation.

Adjusting bias between the before and after groups

As discussed in the data and method section under the heading of “before and after groups”, there are several observable differences between the composition of the before and after groups that could impact on the results. These differences in observable characteristics between the two groups reflect a difference in the probability of each group being interviewed in the NZGSS: people with a stable residential address – such as social housing – are more likely to be reached by interviewers for a household survey than those without a permanent residence.

Although we cannot directly observe all of the characteristics that affect the probability of a social housing applicant being interviewed in the NZGSS, we can observe a range of demographic and socio-economic characteristics that differ between the before and after samples. In particular, the before group undercounts younger and older age groups and undercounts single adult households. These households are likely to have poorer outcomes than other household types and may bias the results in tables 6 and 8.

One way to address the potential bias raised by the composition of the before and after groups is to look at whether the variation between the two groups persists after controlling for the differences in the observable characteristics between the two groups. To do this we estimate a regression for each of the wellbeing outcomes of interest. These take the following form:

$$X = \beta_0 + \beta_1 D + \beta_2 Y + \beta_3 T + \beta_4 W + \varepsilon$$

Where X is the wellbeing outcome of interest, D is a vector of demographic controls, Y is log income, T is a dummy variable for being in the after group, and W is the survey wave. We are interested in observing whether coefficient β_3 , which captures the impact of being in the after group on the wellbeing outcome of interest, is significant after controlling for all of the other factors³. Table 9 below presents regression results for the key wellbeing outcomes in tables 6 and 8 that showed a significant difference between the before and after groups.

³ More specifically, we estimate a series of logistic regressions where the dependent variable is a binary variable with a value of 1 if the respondent has a high life satisfaction, lives in a mouldy, cold, or crowded house, or feels safe walking at night respectively.

Table 9. Wellbeing outcome regressions

Variable	Life satisfaction	House is mouldy	House is cold	House is crowded	Feel safe walking at night
Age	0.0059	0.12	0.02	0.21	0.02
Age ²	-0.0002	-0.0015	-0.0008	-0.003	0.00
Female	-0.72	0.59	0.48	-0.35	-1.00*
Māori	0.24	-0.08	-1.00*	0.45	0.92*
Pacific	-0.31	-0.57	-0.11	1.93**	0.20*
Log HH income	1.40***	-0.35	-0.01	2.03**	0.09
After	1.26**	-0.88 (p: 0.10)	0.004	-0.92 (p: 0.14)	-1.35**
Wave	0.11	-0.42	0.14	-0.07	0.46

Source: NZGSS 2008,-2014, HNZ Social Housing dataset

Significance: * 95%; ** 99%; *** 99.9%.

The impact of being in the after group on life satisfaction and feelings of safety is stronger once differences in the composition of the before and after groups are accounted for. Although both variables just miss out on being significant at the 95% level in a simple comparison between the before and after groups in table 8, they are comfortably significant at the 99% level after attempting to control for differences in the composition of the before and after groups in table 9. In contrast, the impact of moving into social housing on mould and crowding appears to be less significant after adding controls. However, even here mould remains significant at the 90% level and crowding at 85%. The impact of placement in social housing on whether or not the house is cold is not even close to significant once controls are added.

Overall, controlling for observable bias between the before and after groups strengthens confidence in the results presented in tables 6 and 8. Although we cannot rule out the impact of unobservable differences between the before and after groups, the fact that the effect tends to strengthen when we control for those observable differences that we are able to, is positive. However, the small sample size of the before and after groups (132) limits the number of control variables that can be applied, meaning that the regressions themselves should be interpreted with care. In particular, the small sample size limited the number of controls that could be included in the regressions without running the risk of over-identification. A larger sample size would enable a more rigorous treatment of bias between the before and after groups.

Valuing housing outcomes

A key challenge inherent in social policy is how to value different types of outcomes when these have no obvious common metric. For example, how should policy makers value the improvement in wellbeing associated with being placed in social housing compared to, say, the gains resulting for treating a person with a mental health disorder? Simply measuring the cost of providing the service tells us little about which option has the higher benefit to cost ratio. This issue is particularly significant in social policy given that most social policy interventions aim at outcomes that are not readily measured in financial terms.

The “after” coefficient can then be interpreted as the log of the odds ratio for the after group relative to the before group of the dependent variable having a value of 1.

One interesting extension of the before/after analysis is to estimate an overall value for the improvement in wellbeing associated with placing someone in social housing. We can do this by using life satisfaction – a measure of a person’s overall assessment of their life as a whole – as a common metric for evaluating the impact of different policies. This approach to valuing non-market outcomes is increasingly used by economists since there is good evidence that it produces meaningful results (OECD, 2013; Fujiwara, 2013) and is at least as robust as more traditional approaches. However, compared to traditional approaches using life satisfaction to estimate the value of non-market outcomes has the additional advantage that it is relatively easy and inexpensive to implement.

The method for obtaining a dollar value for social housing is relatively straight-forward. First, we need one or more estimates of the impact of being placed in social housing on overall life satisfaction. We supplement this with an estimate of the impact of a change in income on life satisfaction. By comparing the magnitude of these two effects we can calculate the amount of income a person would have to receive in order to increase their life satisfaction by the same amount as being placed in social housing. This quantity is equivalent to what economists refer to as the “compensating surplus” and can be thought of as a valuation in dollar terms for the wellbeing impact of social housing⁴.

Table 10 captures the impact of being placed in social housing on overall life satisfaction, but only reports the change in the proportion of people who report low life satisfaction (1 to 3 on a 5 point scale). To calculate the compensating surplus, we need to know the mean change in life satisfaction between the before and after groups. This is given in table 10 below.

Table 10. Mean life satisfaction score (1-5) before and after placement in social housing

Measure	Before	After	Change
Life satisfaction (1-5)	3.521	3.802	0.281

Source: NZGSS 2008,-2014, HNZ Social Housing dataset

⁴ More formally, if life satisfaction is L, income is Y, T is a dummy variable indicating successful placement in social housing, and D is a vector of demographic controls, then we can estimate the equations:

$$L = \beta_0 + \beta_1 D + \beta_3 T + \varepsilon$$

and

$$L = \beta_0 + \beta_1 D + \beta_2 Y + \varepsilon$$

If all the relationships are linear, the compensating surplus can be calculated as:

$$CS = \frac{\beta_3}{\beta_2}$$

Because the empirical relationship between income and life satisfaction is actually log-linear rather than linear, calculating the compensating surplus is a little more complex. In particular, it is necessary to specify the initial income point for the calculation M^0 :

$$CS = M^0 - e^{\left[\ln(M^0) - \frac{\beta_3}{\beta_2}\right]}$$

While table 10 reports the average difference in life satisfaction before and after placement, there is the possibility that this estimate is biased due to the different composition of the two groups. One way to compensate for this is to estimate a regression that controls for differences in the two populations and look at the coefficient on being in the after group as opposed to the before group. This is similar in concept to the results presented earlier in table 9, but with the 5 point life satisfaction score as the dependent variable, instead of a binary variable for being in the group of people with low life satisfaction (see annex 4 for full results). As can be seen from table 11 below, the coefficient for being in the after group is 0.407, indicating that people in the after group have a life satisfaction score that is 0.407 points higher on average than the before group. This difference is significant at the 95% level (which also strengthens the case that the differences reported in table 8 are meaningful).

Table 11. The marginal impact of placement in social housing on life satisfaction

Variable	Coefficient
Age	0.017
Age2	-0.0002
Female	-0.183
Māori	0.162
Pacific	0.014
Log HH income	0.570***
After	0.407*
Wave	0.084

Source: NZGSS 2008,-2014, HNZ Social Housing dataset

The fact that the estimated impact of being placed in social housing on life satisfaction is higher (0.407 compared to 0.281) is plausible given the differences in composition between the before and after groups. As discussed earlier, the before group captures relatively fewer young single adults, who are likely to have poorer outcomes than other parts of the population. This would lead the simple comparison of means to underestimate the impact of placement in social housing on life satisfaction. In the valuation analysis that follows both estimates are used in order to give a range of results that are robust to compositional effects i.e. they hold regardless of the different composition of the before and after groups.

In addition to estimates of the impact of social housing on life satisfaction, a wellbeing valuation also requires estimates of the impact of income on life satisfaction. The income measure in the NZGSS is collected in bands and does not capture changes in income. For this reason NZGSS data cannot be used to get a robust estimate of the relationship between income and life satisfaction. Instead, three different estimates of the income/life satisfaction relationship are drawn from the academic literature (Frijters et al, 2004; Fujiwara, 2013; and Boarini et al, 2016). These estimates all have a strong identification strategy for establishing the causal relationship between the change in income and life satisfaction and provide a good range of potential estimates for the size of the relationship. Table 12 lists the estimated effect of income on life satisfaction for all three sources and converts these to the equivalent impact on a five point life satisfaction scale.

Table 12. Estimated impact of income changes on life satisfaction

Source	Income measure	Life satisfaction measure	Impact on life satisfaction	Standardised impact on life satisfaction (5 point scale)
Frijters et al (2004)	Log net real household income	0-10	0.5	0.23
Fujiwara (2013)	Log household income	1-7	1.1	0.79
Boarini et al (2016)	Log average household disposable income	0-10	1.3	0.59

Table 13 presents estimates of the compensating surplus for being placed in social housing based on figures from tables 10, 11, and 12 and assuming a median income of \$15,451 in \$2017⁵. These estimates range from \$4,624 using the smallest estimate of the impact of housing on life satisfaction and the largest estimate of the impact of income on life satisfaction, through to \$12,818 using the higher estimate for the effect of social housing and the lowest estimate for income. At the lower estimate this is telling us that the average successful social housing recipient would be indifferent between being placed in a social house and retaining their current income or not being placed but receiving an increase to their annual income of \$4,624.

Table 13. Estimated compensating surplus associated with placement in social housing

Income coefficient used	Using raw difference between before and after placement (table 10)	Using marginal coefficient of being in the “after” group, controlling for demographics differences (table 11)
Frijters et al (2004)	\$ 10,897	\$ 12,818
Fujiwara (2013)	\$ 4,624	\$ 6,220
Boarini et al (2016)	\$ 5,854	\$ 7,699

How should the values estimated for being placed in social housing be interpreted? One useful benchmark is that providing social housing has a net cost per household to the New Zealand Government of approximately \$7,800 per year on average (Housing New Zealand Corporation, 2010)⁶. If the average household size for social housing applications is 1.5 adults, this would suggest that there is a positive benefit to cost ratio for social housing for 3 of the 6 estimates in table 13 (Frijters et al under both columns and Boarini et al under the right hand column).

A second point to be taken from table 13 is that wellbeing valuations of this sort are highly sensitive to the assumptions used. This is a reason to be strongly sceptical of arguments that move

⁵ To calculate the compensating surplus for being placed in social housing it is necessary to specify an assumed starting income. This is because the relationship between income and life satisfaction is not linear: it will take a larger increase in income to improve a person’s life satisfaction by 1 point if their starting income is \$100,000 per year than if it is \$10,000 per year. For the purposes of the estimates given below, the median equalised household income for people who applied for and were placed in Housing New Zealand houses at the time of application is used. This was equal to \$15,451 in \$2017

⁶ The cost is a broad estimate based off crown appropriations for the income related rent subsidy as reported in the HNZ annual report 09/10, and HNZC household stock numbers for 2010.

directly from an estimated benefit to cost ratio through to a policy recommendation. Relatively small changes in the data or starting assumptions can easily reverse whether the proposal under consideration has a value greater than the cost. However, such estimates may be more useful in comparing two different proposed uses of government funds. Where values for two different proposals are evaluated by the same method, and with the same assumptions, conclusions about their relative merits will be more reliable.

Limitations

Although the picture that emerges from this analysis on the impact of social housing on wellbeing is both interesting and plausible, it is important to be clear about the limitations of the research. Knowing about the main limitations informs decisions about how much weight to give these findings as opposed to prior beliefs and the results of other research. It also sets the direction for future research by helping to identify areas where further work would significantly improve the accuracy and reliability of estimates of the effect of social housing on peoples' wellbeing.

There are four main limitations associated with the data and methodology used in this paper. While none of these mean that the results are necessarily wrong, all deserve to be taken seriously. These are:

- Wellbeing impacts are for **before and after, not control and treatment** – we don't have a strong counterfactual
- There is a **bias in the sample of people we can observe in the NZGSS** – people who need social housing are often harder to find before they are in social housing than afterwards
- The **sample size is very small** – the number of people placed in a HNZ house who are also interviewed in the NZGSS in the same year is very small
- The **time frame is limited** – we do not observe long term effects.

Before and after, not control and treatment

One of the most important limitations associated with this analysis of the impact of social housing is that the impact measure captures the situation of the population before and after placement in social housing rather than identifying a true treatment and control group. The distinction here is subtle, but important. In a true experimental study, the difference in outcomes between the treatment and control group can be interpreted as causal: the control group provides a clear counterfactual for what happens to people in the absence of the intervention. This is not the case for a before/after comparison. While the outcomes presented here do show the average difference between people before and after being placed in social housing, it is likely that some of the change in outcomes between the before and after groups is simply a function of the fact that people's outcomes change over time.

In particular, it is common for people applying for some form of social assistance to have particularly poor outcomes. A consequence of this is that, even without assistance, average outcomes will tend to improve over time. This phenomenon is known as Ashenfelter's dip (Ashenfelter, 1978), and means that a simple before/after comparison is likely to over-estimate the impact of an intervention compared to a more rigorous treatment/control comparison. In the context of this study it implies that the true gains in life satisfaction and housing quality associated with being placed in social housing are likely to be **smaller** than the estimates presented here.

While the analysis in this report makes only a before/after comparison, there are a number of possible extensions to the work that would help address some of the methodological limitations associated with Ashenfelter's dip. The most obvious of these is to apply some form of regression discontinuity analysis and look at the outcomes of people who applied for social housing, were given a high priority by HNZ, but were nevertheless not placed in social housing. By comparing the outcomes for this group to the after group in the existing analysis it would be possible to produce a significantly improved counterfactual.

Bias in the sample of people we can observe in the NZGSS

The second major issue with the analytical approach adopted here is the bias in the composition of the before and after groups. In principle we should expect the two groups to have the same make-up as they are selected to be the same group of people at different times. In practice, because the NZGSS is a household survey and people applying for social housing often lack a permanent address, the before group is smaller and systematically different to the after group. Younger people, single people, and the worst off are less likely to be picked up in the NZGSS before they are placed in social housing than afterwards.

The effect of these missing people in the before group will be to make the situation of the before group look better than is actually the case. If people missing from the before sample are disproportionately likely to have poor outcomes, the average position of the people who are interviewed in the before group will be better than would be the case if we could measure everyone. The effect of this will be to bias the measured effects of being placed in social housing downwards. In other words, this implies that the true gains in life satisfaction and housing quality associated with being placed in social housing are likely to be **larger** than the estimates presented here. This is the opposite of the problems associated with the before/after methodology discussed above.

There are a number of techniques available for controlling for sample bias that could potentially be applied here. A Heckman correction is one common econometric technique (Heckman, 1979). However, another option is to match the after sample to the composition of the before sample along demographic lines. This was done with the existing data to produce alternative estimates for the before and after samples (see annex 3). The results do not suggest any major changes to the conclusions of the research, but are constrained by the small sample size (see below). Small sample size also limits the ability to control for differences in the before and after samples through regression analysis.

The sample size is very small

Perhaps the most significant limit on the analysis of the wellbeing outcomes associated with social housing conducted here has been the small sample size. Despite starting from a large dataset (27,759 observations in the NZGSS 2008-2014 matched to the IDI spine), in the final analysis there are only 132 observations that meet the criteria to be included in the before/after comparison. This has two important effects. First, it means that **only the largest changes in wellbeing outcomes will be statistically significant**. Some outcomes – such as the fall in the proportion of people reporting their house to be cold from 43.8% to 35.7% – are likely to be genuine. However, with a sample size of only 132 even an 8.1% change is too small to be accepted as significantly different from 0.

The second problem associated with a small sample size is that it **limits the ability to control statistically for other methodological issues** such as the differences in composition between the before and after samples. This occurs regardless of whether the approach involves matching the samples or using regression techniques to control for differences in the samples.

There is no simple methodological fix for a small sample size. However, three points are worth making. First, the sample size can be increased by about 20% when the NZGSS 2016 wave becomes available in the IDI. While this is not a large change, it may increase the sample size enough to shed light on some marginally non-significant results. Second, future increases to the sample size or the frequency of the NZGSS would help to address this issue and make the analytical technique explored here more widely useful. Finally, the small sample size in this analysis results partly from the number of placements in social housing that take place each year. More frequent events, such as employment transitions, might be less subject to sample size related issues.

The time frame is limited

There is one last major limitation associated with the methodology used here. This relates to the timeframe for the before/after comparison. Because the before and after groups are created from a range of individual observations in the period 15 months before and 12 months after being placed in social housing, they each reflect a snapshot of people's circumstances at a particular point in time. The before group gives the average situation for people 247 days before being placed in social housing, while the after group shows the average situation of people 196 days after being placed. Clearly, however, people's situation will change both in the period leading up to being placed in social housing and once they have been placed.

The timing of the before snapshot should not have a large effect on the estimated impact of being placed in social housing. If anything it will lead to a slight bias downwards in the estimated effect compared to the true effect as it may capture some people before their housing situation deteriorates. The timing of the after snapshot is more problematic. Some outcomes – such as the incidence of respiratory disease – are known to be affected by housing quality, but such effects take time to show up. We would not expect to see large changes in health outcomes only three months after being placed in social housing even though there is excellent evidence that improvements in housing quality through placement in social housing are associated with improved health outcomes (Keall et al, 2010). Hence the time frames associated with the methodology used here are likely to mean that the true effect for some important wellbeing outcomes is **larger** than the estimate given here.

Addressing the time frame issue is difficult with the before/after methodology adopted here. While it would be possible to use the combined NZGSS/HNZ dataset that forms the basis of this report to look at the wellbeing outcomes for people resident in social housing over a long period, it would be difficult to construct a meaningful counterfactual/comparison group.

Discussion

Wellbeing has been part of the policy agenda for some time but has been given particular impetus through the OECD World Forums on Statistics, Knowledge and Policy (2004, 2007, 2009, 2012, 2015) and following the release of the Sen/Stiglitz/Fitoussi report in 2010. While early attempts to

measure wellbeing faced conceptual and data-related challenges, there has been considerable progress in measuring national wellbeing over the last 15 years. This can be seen in the relatively widespread adoption of a consistent framework for measuring wellbeing similar to the framework used in the OECD Better Life Initiative and grounded in the recommendations of the Sen/Stiglitz/Fitoussi report.

Despite rapid progress in measuring national wellbeing, analyses of the wellbeing impacts of policy interventions are scarcer. There is a growing literature on the use of subjective wellbeing measures to evaluate policy (e.g. O'Donnell et al, 2014; Fujiwara, 2013), but almost nothing in the way of attempts to assess the impact of policy interventions on wellbeing at the individual level across the full range of wellbeing domains identified in the OECD or a similar multi-dimensional framework.

The primary aim of this piece of research was to explore the degree to which it was possible to identify the multidimensional wellbeing impacts of a policy intervention in New Zealand using data from the IDI. Social housing was used as a proof of concept with the view that, if it proved possible to provide a meaningful view of the wellbeing impacts of this policy intervention it would then be possible to apply the methodology more widely. Beyond the proof of concept, there is of course a strong interest in any policy implications arising from the analysis of the wellbeing impacts of placing someone in social housing. However, these need to be considered with care given that the methodology applied here is novel.

The main conclusions from this research fall into three broad groups. The first two relate to the ability to produce a meaningful analysis of the individual level wellbeing outcomes associated with a policy change and to the policy implications that can be drawn from the social housing analysis. The third set of conclusions are more general and relate to the structure of the IDI and the New Zealand Data environment.

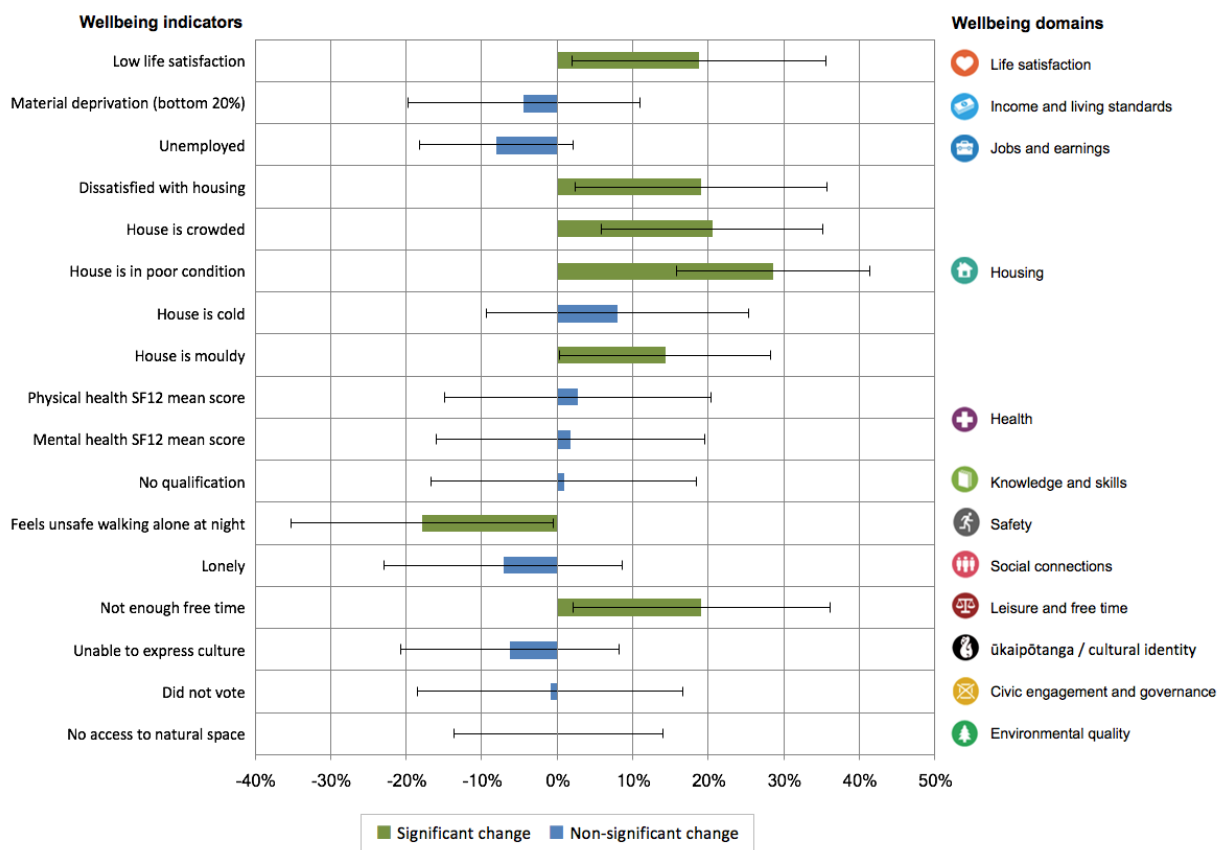
These three sets of conclusions are discussed under the headings:

- measuring wellbeing
- policy implications
- data implications

Measuring wellbeing

If one of the aims of this piece of research was to test whether it is possible to examine the impact of a policy initiative in terms of individual wellbeing, then a key measure of success is whether it is possible to produce a clear picture of the impact of being placed in social wellbeing across the different wellbeing domains in the SIA wellbeing measurement approach. Figure 2 below shows the change in wellbeing indicators between the before and after groups across all of the domains of the SIA approach with the exception of the Self domain, for which there are no potential indicators in the NZGSS 2008 – 2012 waves. For most wellbeing domains only one indicator is used, but health and housing are exceptions. There are separate indicators for the two distinct aspects of health: mental health and physical health. Similarly, there are five indicators related to housing, each capturing a different aspect of housing quality. This reflects the fact that social housing is targeted primarily at improving housing outcomes.

Figure 2. Change in wellbeing before and after placement in social housing: all outcomes



Note: The dimensions shown in the graph are largely based on those included in the OECD Framework for measuring well-being and progress (OECD, 2011).

Each bar in figure 2 shows the change in an indicator. A positive value for the bar indicates that the indicator is lower for the after group than the before group, indicating a reduction in the relevant poor outcome (all indicators are framed in negative terms). For example, the proportion of the after group with low life satisfaction is 18.8% lower than is the case for the before group.

The picture presented in figure 2 illustrates that it is possible to provide a meaningful picture of the wellbeing impact of a policy intervention across the full range of wellbeing domains. More importantly, it should be remembered that the analysis underpinning figure 2 was put together from already existing information. It does not represent the results of a tailored study, but is assembled from existing information in the IDI. The implication of this is crucial: **what we can do for social housing we can do for other policy interventions**. The main constraint is sample size, which currently limits the analysis to events for which there are 20,000 or more transitions each year. However, an increase in the NZGSS sample size or frequency of collection would allow smaller interventions to be examined.

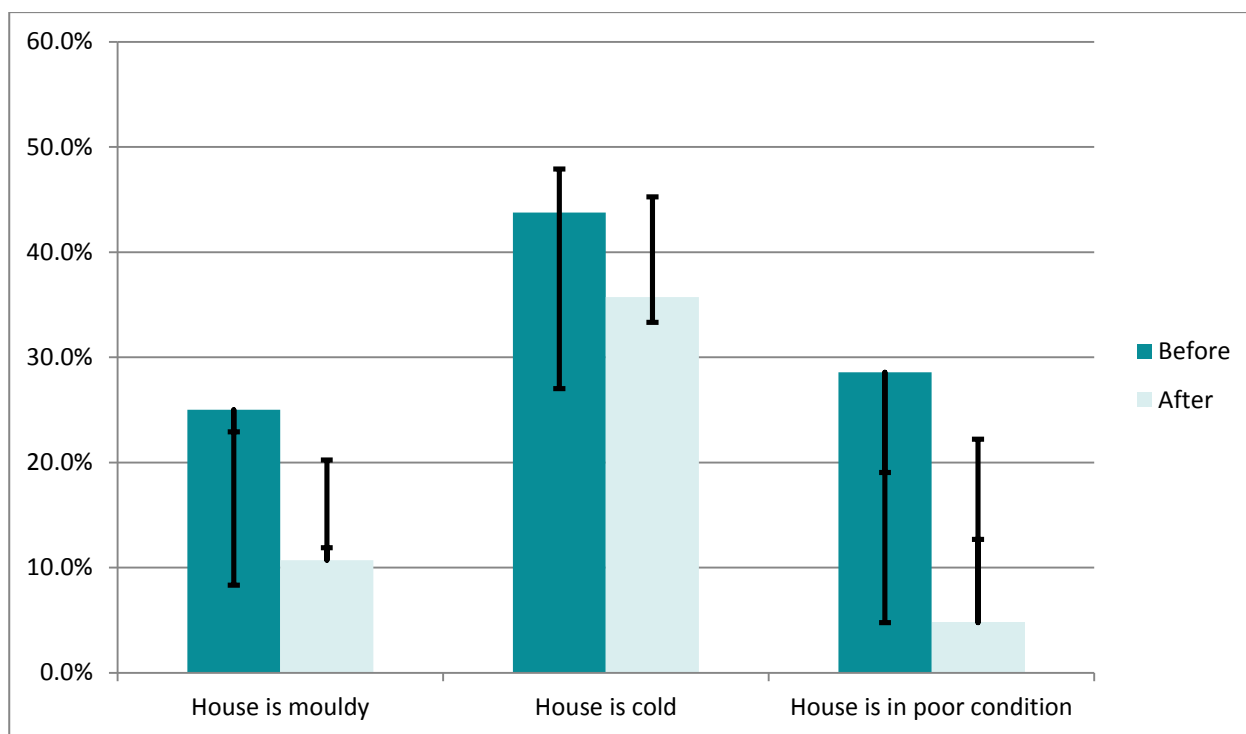
Policy implications

Given the various methodological limitations associated with the analytical technique used here, it is necessary to be careful when drawing policy conclusions. Both the small sample size, and the response bias between the before and after groups, mean that any policy conclusions can only be considered tentative. Nonetheless, there are two points that emerge from the analysis that are

sufficiently interesting to warrant follow-up. While neither of these findings should be considered conclusive, it would be valuable to see if other sources of data confirmed them.

The first issue for further investigation is the observation that while both mould and general housing condition improve with placement in social housing, this does not appear to be the case for whether or not the house is cold. There is no significant difference between the before and after groups in terms of the NZGSS measure of household temperature (see figure 3 below).

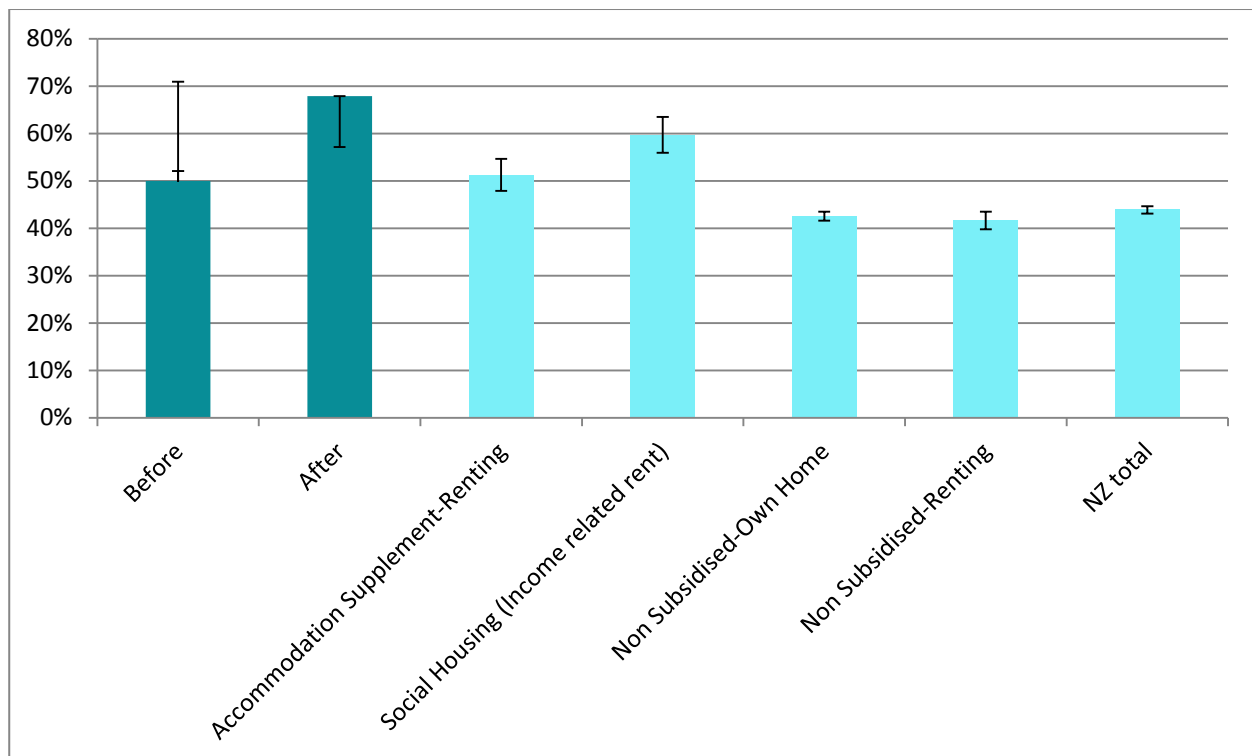
Figure 3. Aspects of housing quality before and after placement in social housing



One interpretation of figure 3 might be that, while mould and housing condition represent a problem with the house in which a person is living, whether someone feels able to turn on the heater is a function of their income. Thus a policy intervention such as social housing, which affects where someone lives, may need to be accompanied by improvements to a person's income if it is to have a significant impact on the experience of cold housing. It would therefore be interesting to test whether this interpretation of the data was supported by other sources of evidence or feedback from social housing providers.

The second finding that might be worth further investigation is the fact that feelings of safety appear to deteriorate when people move into social housing. Although peoples' overall wellbeing improves when they move into social housing (figure 2), it is clear that perceived safety deteriorates (figure 4). Interestingly this is not just a transition effect, but also persists in that people living in social housing have lower perceived safety than people in any other housing circumstances.

Figure 4. Feeling unsafe walking in the neighbourhood at night, before and after placement in social housing and total population



It is relatively easy to imagine why moving into social housing might be associated with lower levels of perceived safety. Social housing is likely to be concentrated in more deprived areas and is likely to be co-located with other social housing. People may feel more threatened both because they have relocated to a new neighbourhood that is unfamiliar to them, and because the neighbourhood that they move to has a high proportion of people who are initially perceived as threatening.

As is the case with cold housing, this finding would need to be confirmed from other sources before acting on it. However, if it were true it raises the possibility that there might be relatively inexpensive policy interventions available to social housing providers that would improve overall wellbeing. The perceived deterioration in safety is almost certainly over-estimated by new social housing recipients (note that average feelings of being unsafe are lower for social housing recipients overall than for those recently placed in figure 4). This suggests that relatively simple interventions to connect social housing recipients with their neighbours and community might help.

Data implications

Although it is tempting to regard the substantive findings as the most important outcome from this analysis, this would be misleading. As a proof of concept, one of the key goals for the work on social housing and wellbeing has been to establish what can be done by using social survey data in the IDI. In doing so a number of key lessons were learned. The most important of these are that:

- Survey and administrative data are **complements not substitutes** in the IDI
- The **NZGSS is particularly valuable** because most of the data it obtains has no direct equivalent in the IDI

- Survey data could be **designed to take advantage of the IDI** data much better.

Survey and administrative data are complements not substitutes in the IDI

Because it is relatively easy to identify areas where administrative data from the IDI can substitute for survey data (e.g. using IRD tax data for to provide information on personal income), it is not always easy to articulate why survey data continues to be important. However, the analysis of wellbeing and social housing here illustrates the degree to which survey data actually complements administrative data in the IDI. By providing information about outcomes that cannot be observed through administrative records, survey data dramatically expands the types of question that can be meaningfully examined.

In particular, survey data can capture concepts that simply will never likely to be reflected by administrative records (e.g. life satisfaction). Similarly, survey data can provide measures of outcomes (e.g. was the house cold?) rather than the service delivered (e.g. was the person in social housing?). Both features make survey data especially valuable in evaluating the effectiveness of social policy interventions (where it is difficult to obtain good outcome measures from service usage) and potentially in looking at the intangible drivers of service usage and outcomes.

The NZGSS is particularly valuable because most of the data it obtains has no direct equivalent in the IDI

Of all Statistics New Zealand's household surveys, the NZGSS is of particular value in the IDI. Where other household surveys are focused around concepts that can be measured relatively well through administrative data (e.g. the Household Economic Survey mainly collects income data that can also be sourced from IRD tax records), the NZGSS focuses heavily on social outcomes that are not reflected in administrative datasets. Information on people's subjective mental states, social connections, levels of trust or sense of safety are currently not possible to obtain from administrative data, and in many cases will never be obtainable from these sources. However, measures of this type are of immense analytical value in evaluating social policy interventions. For this reason, the NZGSS should be regarded as a critical piece of the IDI infrastructure and is a strong candidate itself for investment in data.

Survey data could be designed to take advantage of the IDI data much better

As valuable as the NZGSS currently is, there are a number of obvious changes that would increase the value of the data still further. The most obvious of these would be simply to link all people identified in the household questionnaire into the IDI. Currently only the person responding to the personal questionnaire is linked to the IDI spine, which limits the ability to create household level variables for analysis. Since some of the potentially big gains from the core IDI data involve building household variables this is a severe drawback. For example, a measure of household income derived from IRD data would be immensely more useful for analysis than the relatively crude banded income measure contained in the NZGSS. This cannot be built, however, unless everyone in the household questionnaire can be identified in the IDI.

The other main improvement that could be made to the NZGSS would be to increase its sample size and/or frequency. Sample size was the major methodological limitation on the wellbeing and social housing analysis and represents the main limitation to wider applications of the

methodology to evaluate the impact of other government services. Ideally the NZGSS would be annual (and therefore continuously in the field) with a sample at least the size of the HLFS (c30,000 respondents). This would be represent a four to five fold increase in sample size, and would allow a much more robust analysis of the wellbeing outcomes of social programmes. It is worth noting that, although a larger sample size would be associated with significant cost increases, there would be some scope to partially offset this by eliminating variables that duplicate existing IDI measures. This would suggest a slimmer version of the NZGSS focused more explicitly on complementing administrative data in the IDI by capturing the kind of outcome that administrative data cannot collect.

Next steps

The analysis of the impact of social housing in this paper represents an important first step in building the analytical techniques and tools required to assess the impact of social policy interventions on wellbeing. However, it is only a first step. Next steps will take the work further in several directions. The SIA will:

- Apply the same analytical technique to investigate the wellbeing impact of other interventions, starting with the impact of transitions off benefit and into employment
- Extend the analysis of the impact of social housing by looking at wellbeing impacts over the longer term and from a family perspective, the economic impact of social housing receipt, and extending previous work looking at service usage and fiscal cost
- Work with Statistics New Zealand to look at the data investments required to support the practical use of the techniques applied in this paper to evaluating the impact of social policy
- Engage with other policy agencies to apply the techniques outlined in this paper to build the New Zealand evidence base on the wellbeing impact of social policies and the use of wellbeing data to support cost-benefit analysis across the wider social sector.

The social housing work forms part of a larger and longer term work programme to develop and roll-out a comprehensive measurement system. We expect the upcoming social housing work to take around nine months.

Please get in touch if you have feedback or would like to work with us

The SIA's wellbeing measurement approach is new. The SIA have applied it to one area, and are beginning to develop tools to support its use. The SIA plans to publish a repository of methods, examples, indicators, measures and data sources on its website: <https://sia.govt.nz/>

Please get in touch if you have feedback on our approach and how it has been applied to social housing. We are also keen to hear from you, if you are interested in working with us to apply the model in your area. This will help us refine our approach, provide insights in your area, and help build wellbeing measurement capability across the social system in New Zealand. We would also like to hear about any wellbeing measurement that you have undergone or other material that might assist us. Please contact us at info@sia.govt.nz.

Thank you.

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Annex 1: Concordance between 2008-2012 NZGSS questionnaire and the 2014 NZGSS questionnaire

Variable text	Comments
Household crowding	2014 wave has varchar values instead of numeric. Changed this to smallint.
Mouldy/damp house	Convert 2014 scales to binary, such that value '13 - Major Problem' becomes 1 and everything else is 0. However, Even after transformation, the values doesn't look comparable to the previous waves. NULLS in waves 2008, 2010, 2012 have been classified as 0.
Cold house	Convert 2014 scales to binary, such that value '11 - Yes, always & 12- Yes Often' becomes 1 and everything else is 0. However, Even after transformation, the values doesn't look comparable to the previous waves. NULLS in waves 2008, 2010, 2012 have been classified as 0.
House condition	Nulls for 2014 wave. Integer conversions for other waves
Housing satisfaction	Nulls for 2014 wave. Integer conversions for other waves. 11-very satisfied & 12-Satisfied were converted to 1, all else to 0.
Cultural identity	Mostly the same questions except for the response wording. Counts seem to be different between 2014 and previous surveys. Created a binary indicator with '11-very easy' and '12-easy' as 1, (88, 99, NULL) as NULL, and others a 0.
Life satisfaction	Changed from 11 point to 5 point scale and adjusted for flipped values for older NZGSS waves. Scores were mapped as 0 or 1 to 1; 2, 3 or 4 to 2; 5 to 3; 6,7, or 8 to 4; and 10 to 5.Added -1 for NULL values
Voting	Yes/no
Time lonely	Scales flipped between 2014 and rest.

Annex 2: Regression results showing impact of moving into a new house

Life satisfaction

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	6.888e-01	4.131e-01	1.668	0.095410	.
age	-7.188e-02	7.511e-03	-9.571	< 2e-16	***
age2	7.704e-04	7.484e-05	10.294	< 2e-16	***
snz_sex_codeFEMALE	-5.295e-03	4.903e-02	-0.108	0.913994	
snz_ethnicity_grp2_nbr	-2.296e-01	6.358e-02	-3.611	0.000306	***
snz_ethnicity_grp3_nbr	-1.637e-01	9.224e-02	-1.774	0.076027	.
snz_ethnicity_grp4_nbr	-1.404e-01	8.874e-02	-1.582	0.113599	
snz_ethnicity_grp5_nbr	-7.241e-02	7.402e-02	-0.978	0.327933	
snz_ethnicity_grp6_nbr	-1.815e-01	6.919e-02	-2.623	0.008729	**
sch_qual_ind	4.298e-01	6.442e-02	6.672	2.58e-11	***
higher_sch_qual_ind	4.391e-01	6.468e-02	6.789	1.15e-11	***
tertiary_qual_ind	7.483e-01	9.810e-02	7.628	2.46e-14	***
postgrad_qual_ind	9.973e-01	1.158e-01	8.612	< 2e-16	***
unemployed_ind1	-8.435e-01	9.754e-02	-8.648	< 2e-16	***
log(hh_income_numeric + 1)	2.227e-01	2.465e-02	9.034	< 2e-16	***
residence_count_total	-9.574e-02	1.496e-02	-6.400	1.58e-10	***
log(days_in_house_b4 + 1)	-8.818e-03	2.819e-02	-0.313	0.754401	
log(days_in_house_after + 1)	3.436e-02	2.763e-02	1.244	0.213626	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for quasibinomial family taken to be 0.9898341)

Number of Fisher Scoring iterations: 5

Annex 3: Regression controls for bias

Life satisfaction

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-1.378e+01	4.894e+00	-2.815	0.004881	**
age	5.906e-03	7.535e-02	0.078	0.937521	
age2	-2.390e-04	8.613e-04	-0.278	0.781374	
snz_sex_codeFEMALE	-7.224e-01	4.719e-01	-1.531	0.125802	
eth_maoriY	2.444e-01	4.580e-01	0.534	0.593554	
eth_pacificaY	-3.116e-01	5.140e-01	-0.606	0.544427	
log(hh_income_numeric + 1)	1.402e+00	4.248e-01	3.300	0.000967	***
treat_control_mainTREATED	1.262e+00	4.593e-01	2.748	0.006004	**
wave	1.093e-01	1.796e-01	0.609	0.542689	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 168.04 on 131 degrees of freedom
Residual deviance: 143.70 on 123 degrees of freedom
(15 observations deleted due to missingness)
AIC: 161.7

Number of Fisher Scoring iterations: 4

House mouldy

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	0.693332	5.929937	0.117	0.9069	
age	0.121321	0.120715	1.005	0.3149	
age2	-0.001470	0.001451	-1.013	0.3109	
snz_sex_codeFEMALE	0.589876	0.610599	0.966	0.3340	
eth_maoriY	-0.075780	0.566197	-0.134	0.8935	
eth_pacificaY	-0.565586	0.732950	-0.772	0.4403	
log(hh_income_numeric + 1)	-0.345597	0.486479	-0.710	0.4775	
treat_control_mainTREATED	-0.877135	0.535759	-1.637	0.1016	
wave	-0.422103	0.236395	-1.786	0.0742	.

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 112.29 on 131 degrees of freedom
Residual deviance: 100.69 on 123 degrees of freedom
(15 observations deleted due to missingness)
AIC: 118.69

Number of Fisher Scoring iterations: 5

House cold

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.2293378	4.0921743	-0.056	0.9553
age	0.0243116	0.0831477	0.292	0.7700
age2	-0.0008607	0.0010612	-0.811	0.4173
snz_sex_codeFEMALE	0.4817149	0.4311004	1.117	0.2638
eth_maoriY	-1.0011209	0.4357062	-2.298	0.0216 *
eth_pacificaY	-0.1137095	0.4867851	-0.234	0.8153
log(hh_income_numeric + 1)	-0.0121959	0.3589396	-0.034	0.9729
treat_control_mainTREATED	0.0039161	0.4143288	0.009	0.9925
wave	0.1403028	0.1687584	0.831	0.4058

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 175.16 on 131 degrees of freedom
Residual deviance: 159.41 on 123 degrees of freedom
(15 observations deleted due to missingness)
AIC: 177.41

Number of Fisher Scoring iterations: 5

Household crowding

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-25.342034	6.967803	-3.637	0.000276 ***
age	0.207608	0.192297	1.080	0.280310
age2	-0.003367	0.002882	-1.168	0.242618
snz_sex_codeFEMALE	-0.352306	0.653936	-0.539	0.590061
eth_maoriY	0.452842	0.713458	0.635	0.525615
eth_pacificaY	1.928270	0.705241	2.734	0.006253 **
log(hh_income_numeric + 1)	2.031034	0.621579	3.268	0.001085 **

```
treat_control_mainTREATED -0.924694 0.625586 -1.478 0.139375
wave -0.065613 0.260328 -0.252 0.801010
```

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 118.948 on 131 degrees of freedom

Residual deviance: 74.245 on 123 degrees of freedom

(15 observations deleted due to missingness)

AIC: 92.245

Number of Fisher Scoring iterations: 7

Safe walking at home at night

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-2.248e+00	4.135e+00	-0.544	0.58675
age	2.048e-02	6.864e-02	0.298	0.76549
age2	1.697e-05	7.969e-04	0.021	0.98301
snz_sex_codeFEMALE	-1.001e+00	4.461e-01	-2.244	0.02480 *
eth_maoriY	9.203e-01	4.444e-01	2.071	0.03837 *
eth_pacificaY	2.040e-01	4.885e-01	0.418	0.67617
log(hh_income_numeric + 1)	9.363e-02	3.597e-01	0.260	0.79463
treat_control_mainTREATED	-1.351e+00	4.477e-01	-3.018	0.00254 **
wave	4.645e-01	1.798e-01	2.583	0.00979 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 177.01 on 131 degrees of freedom

Residual deviance: 155.85 on 123 degrees of freedom

(15 observations deleted due to missingness)

AIC: 173.85

Number of Fisher Scoring iterations: 4

Annex 4: Regression control for bias, mean score

Life satisfaction mean score

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	-2.7182206	1.7995461	-1.511	0.13348	
age	0.0173007	0.0300565	0.576	0.56593	
age2	-0.0002455	0.0003487	-0.704	0.48268	
snz_sex_codeFEMALE	-0.1826161	0.1861324	-0.981	0.32846	
eth_maoriY	0.1616574	0.1847904	0.875	0.38338	
eth_pacificaY	0.0143294	0.2098675	0.068	0.94567	
log(hh_income_numeric + 1)	0.5699019	0.1559325	3.655	0.00038	***
treat_control_mainTREATED	0.4065797	0.1840955	2.209	0.02906	*
wave	0.0843431	0.0728801	1.157	0.24940	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.9497 on 123 degrees of freedom
(15 observations deleted due to missingness)

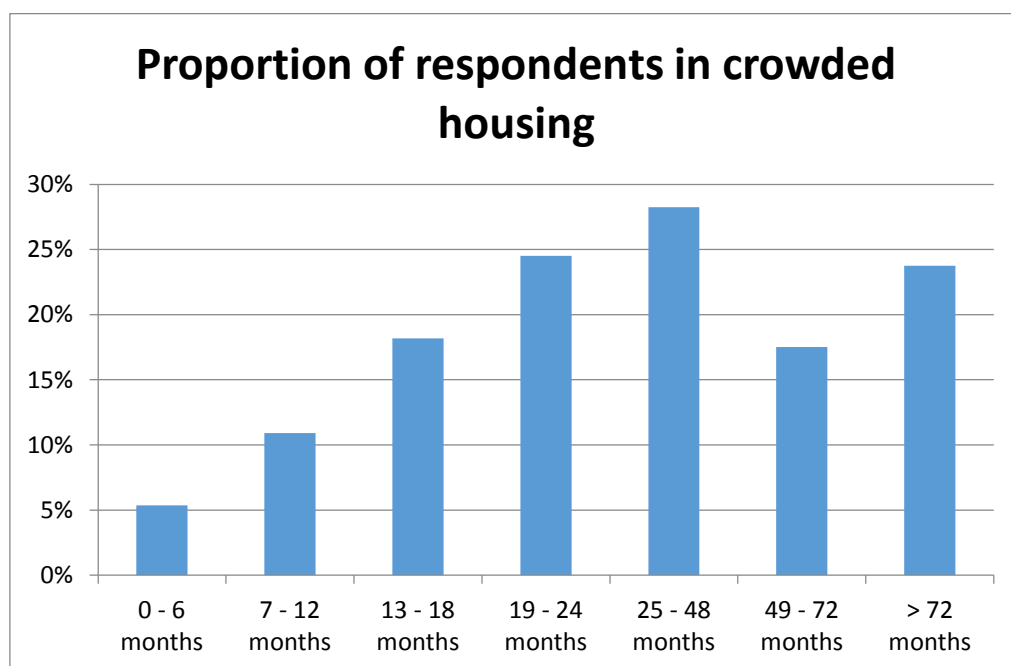
Multiple R-squared: 0.1588,

F-statistic: 2.902 on 8 and 123 DF, p-value: 0.005351

Annex 5: Length of tenancy, mould and crowding

Population: all people recorded as dwelling in Housing New Zealand income related rents properties when interviewed in the NZGSS 2008, 2010, 2012, or 2014 waves. Analysed by time living in property before interview.

Time in SH before Interview	Proportion of respondents in crowded housing	Count
0 - 6 months	5%	54
7 - 12 months	11%	54
13 - 18 months	18%	45
19 - 24 months	25%	54
25 - 48 months	28%	132
49 - 72 months	18%	135
> 72 months	24%	189



Time in SH before Interview	Proportion of respondents in crowded housing	Count
0 - 6 months	5%	54
7 - 12 months	11%	54
13 - 18 months	18%	45
19 - 24 months	25%	54
25 - 48 months	28%	132
49 - 72 months	18%	135
> 72 months	24%	189

Proportion of respondents reporting mould

