



Prioritising Wellbeing Outcomes for Social Housing Tenants: Using Fecundity to Inform Public Policy in New Zealand

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Abstract

The last decade has seen increasing agreement on the measurement of wellbeing. Over this time two main approaches to measuring wellbeing nationally have emerged: multi-dimensional and subjective. Both approaches are widely used in national and international reporting. Progress on applying wellbeing measures in practice to inform policy and decision-making, however, has been less rapid. While there is a small, but growing, literature on the use of subjective wellbeing measures in public policy, there are fewer examples of applying multi-dimensional wellbeing measures in a public policy context. This paper describes wellbeing outcomes for social housing tenants from a multi-dimensional wellbeing survey drawing on the New Zealand Treasury's Living Standards Framework. Building on the Alkire-Foster counting methodology, the paper proposes a novel metric for assessing the relative importance of different wellbeing outcomes within the context of a multi-dimensional wellbeing framework. This metric – fecundity – is defined as the number of additional dimensions of hardship that a person experiences conditional on being in hardship in one specific dimension. This fecundity metric is then compared to life satisfaction and the relationship between features of urban design and wellbeing is used as an illustrative case study to demonstrate the applicability of each approach in practice. Under both approaches neighbourhood characteristics and access to services are associated with tenant wellbeing compared to dwelling characteristics and length of connection to the neighbourhood, which have no significant association with life satisfaction and only a weak association with fecundity.

Keywords Wellbeing · Life satisfaction · Multi-dimensional wellbeing · Urban design

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Introduction

Wellbeing is central to public policy in that any democratic government is inherently concerned with the welfare of its citizens. Until recently the challenges involved in measuring wellbeing have meant that narrower measures – often based on what services are delivered rather than the impact of these on people’s wellbeing – have been used to guide policy. Over the last decade, however, there has been increasing agreement that wellbeing is measurable. Following the release of the *Report of the Commission on Measuring Economic Performance and Social Progress* (Stiglitz et al., 2009) two main approaches to measuring wellbeing at the national level have emerged: multi-dimensional and subjective. While the former is grounded in Sen’s capabilities approach to wellbeing (Sen, 1993) and makes use of objective outcome data, the latter takes people’s self-reports of their internal mental states as the benchmark for wellbeing (OECD, 2013). Both approaches are widely used in national (Government of Ireland, 2022; New Zealand Treasury, 2022; Office for National Statistics, 2023) and international (OECD, 2020; Brandt et al., 2022; Helliwell et al., 2023) reporting. However, despite widespread uptake in different contexts, the two measurement approaches have quite different conceptual underpinnings and there is a vigorous debate about which approach is to be preferred (Schokkaert, 2007; Binder, 2014; Austin, 2016; Cummins & Land, 2018; Helliwell et al., 2026).

This paper explores whether the choice of subjective wellbeing or a multi-dimensional approach to measuring wellbeing leads to substantively different judgements about the relative importance of different outcomes within a public policy context. We adapt the Alkire-Forster multi-dimensional counting approach (Alkire et al., 2015) to evaluate the association between different outcomes and overall wellbeing and apply this to a New Zealand dataset capturing information on wellbeing and urban redevelopment. The priority weights identified from this analysis are compared with those that emerge from analysing the relative association between different outcomes and life satisfaction (a measure of subjective wellbeing). The relationship between features of urban design and wellbeing is used as an illustrative case study to demonstrate the applicability of both approaches in practice.

Literature Review

Before proceeding to the empirical part of this paper, it is useful to review the existing literature on the relationship between multi-dimensional and subjective wellbeing and what is known about housing, urban design, and wellbeing.

Multi-dimensional and Subjective Wellbeing

In this paper we use the term multi-dimensional wellbeing measures to refer to measurement approaches that include a range of distinct objective and/or self-reported metrics to capture different “dimensions” of wellbeing, often grounded in the capabilities approach, and without a single summary measure capturing overall wellbeing (e.g. OECD, 2020) as opposed to subjective wellbeing measures which prioritises

self-reports of people's internal mental states and which are characterised by a single summary measure which may be the response to a single question (e.g. Helliwell et al., 2023) or a composite index (e.g. Tennant et al., 2007)¹. Papers in the small, but growing, literature on how to use wellbeing measures in public policy tend to focus only on one of the two main measurement approaches (e.g. Exton & Shinwell, 2018; Frijters & Krekel, 2021), although there are exceptions (Greco et al., 2016). Similarly, the practical applications of wellbeing measures to public policy tend to be concentrated in different areas for each of the two measurement approaches. There is an extensive literature on the use of subjective wellbeing measures to prioritise among different policy outcomes (Ferreira & Moro, 2010; Frijters et al., 2020; Frijters & Krekel, 2021). The use of multi-dimensional wellbeing measures, on the other hand, is largely focused on multi-dimensional poverty measurement in the context of development economics (e.g. Alkire & Santos, 2013; Biagi et al., 2018, Grimes, 2021). This difference in focus can be partly attributed to subjective wellbeing measures providing a unidimensional metric that supports unambiguous conclusions about the relative association between different policy interventions and overall wellbeing. Multi-dimensional approaches, on the other hand, present a more complex picture and the policy conclusions from such analyses can be ambiguous or difficult to summarise.

Several papers consider whether the capabilities-based measures used in the multi-dimensional wellbeing framework are correlated with life satisfaction or happiness. Anand et al. (2009) report the analysis of a purpose-designed capabilities survey and find that, although there are some minor quantitative differences to the relationship between life satisfaction and capabilities across different demographic groups, the main qualitative results do not change. Similar results are reported in Anand et al. (2011), while Boarini et al. (2013) find that wellbeing indicators selected to reflect capabilities also predict life satisfaction. Suppa (2015), finds a strong relationship between capability deprivation and life satisfaction and that there is no evidence of life satisfaction scores reflecting adaption to the experience of capability deprivation. Nozaki and Oshio (2016) find that multi-dimensional poverty is a better predictor of subjective wellbeing than simply looking at any individual dimension of wellbeing on its own. In contrast to the bulk of the literature discussed above, Strotmann and Volkert (2018) find that multi-dimensional poverty is a poor predictor of subjective wellbeing in a study focused on rural India. More recently Kimhur (2023) finds that the choice of wellbeing framework does matter for who is identified as deprived in a comparison between the capabilities approach and measures of material wellbeing (e.g. incomes) when looking at housing inequality in the Netherlands.

Several papers compare indices built to reflect multi-dimensional wellbeing and subjective wellbeing measures. Kroll (2013) finds that weighting the Human Development Index (HDI) based on the relative contribution of its components to life sat-

¹ Note that we use the term multi-dimensional wellbeing measures in this article to refer to approaches largely grounded in Sen's capabilities approach (Sen, 1993) and as exemplified by the OECD's How's Life? framework (OECD, 2020) that conceptualise wellbeing as good outcomes across a number of distinct life domains. This is in contrast to the use of the term "multi-dimensional" to refer to indices of subjective wellbeing constructed by weighting across measures of different aspects of subjective wellbeing such as WEMWBS (Tennant et al., 2007) or the Personal Wellbeing Index (Cummins et al., 2003).

isfaction produces significant differences in cross-country assessments of progress from the baseline HDI. Delhey and Steckermeier (2016) use principal component analysis to develop an index based on multi-dimensional measures of wellbeing and show that this is strongly correlated with life satisfaction. Yin et al. (2023) re-examines the relationship between the HDI and life satisfaction, finding that there is a strong cross-country correlation between the HDI and life satisfaction, but that the equal weighting of HDI domains is not supported for countries outside of the developed world.

We contribute to the literature on multi-dimensional and subjective wellbeing by looking at a concrete policy issue using both subjective and multi-dimensional approaches to evaluating wellbeing. In particular, this paper focuses on the issue of housing, urban design, and wellbeing.

Housing, Urban Design, and Wellbeing

Housing is a key determinant of multi-dimensional wellbeing, influencing not only health outcomes but also broader social and economic factors (Barker, 2019). Quality housing fosters social stability, inclusion, and improved health and education, while shaping land use, transportation, and resource allocation (Barker, 2019). It also provides a sense of belonging, significantly shaping individuals' identities and life experiences (Lomas et al., 2021). There is evidence suggesting strong links between housing satisfaction and subjective wellbeing measures such as life satisfaction, self-esteem, and a sense of control (Coates et al., 2015; Clapham et al., 2018).

However, public housing tenants, despite access to subsidised housing, often experience lower subjective wellbeing compared to the general population (Lomas et al., 2021; Uitermark & Bosker, 2014; Grimes et al., 2024). Data from the New Zealand General Social Survey (NZGSS) reveal that 23.4% of public housing residents reported low life satisfaction, compared to 14.5% of non-subsidised renters and 9.5% of homeowners (Social Investment Agency, 2018). Public housing tenants also face more material deprivation, unemployment, loneliness, and safety concerns, and are less likely to participate in elections (Social Investment Agency, 2018). This discrepancy may result from weaker connections to their homes, variations in housing quality, and disparities in neighbourhood conditions (Uitermark & Bosker, 2014; Lomas et al., 2021).

While some researchers have explicitly explored multi-dimensional (Biagi et al., 2018; Kimhur, 2020) and subjective (Clapham et al., 2018; Das et al., 2022; Grimes et al., 2024) approaches to wellbeing and urban development there is little empirical evidence as to the impact of adopting these different approaches. Coates et al. (2015) explore the role of housing satisfaction as a mediating variable capturing housing capabilities and affecting life satisfaction while Palm et al. (2025) explicitly look at the link between housing and capabilities but use life satisfaction as a measure of the impact of capabilities on wellbeing. Sirowy (2024) explores whether eudaimonic measures should be preferred to hedonic subjective measures – such as life satisfaction – in evaluating the relationship between public space and wellbeing but the focus of the article remains primarily conceptual rather than empirical.

Data

To explore the relationship between multi-dimensional wellbeing and subjective wellbeing this paper uses a dataset designed to capture the relationship between urban redevelopment and tenant wellbeing – the Te Hotonga Hapori Wellbeing Survey (THHWBS). This dataset was collected as part of a five-year study – Te Hotonga Hapori – that aims to evaluate multidimensional wellbeing in the context of the major urban redevelopment currently taking place in Aotearoa New Zealand.

A multi-dimensional wellbeing framework was developed for the programme based on the twelve dimensions of the New Zealand Treasury's Living Standards Framework (Hughes, 2021), which guided the development of the THHWBS². The Living Standards Framework aligns closely with other approaches to measuring wellbeing in a public policy context such as the *OECD's How's Life?* framework (OECD, 2020). Additionally, Māori perspectives on wellbeing were incorporated into the survey due to the overrepresentation of Māori in public housing (Stephens et al., 2022) and New Zealand's bicultural context.

The survey design aimed to achieve three objectives: (1) provide measures across the Living Standards Framework and additional Māori wellbeing dimensions, (2) ensure comparability with national surveys like the NZGSS, and (3) minimise respondent burden to encourage participation. A multi-disciplinary working group selected the best measures for each wellbeing domain, limiting most domains to one or two measures, except in areas related to urban redevelopment. The survey's structure followed that of the NZGSS to ensure consistency and reduce contextual bias. The final survey, with an estimated completion time of 20–25 min, underwent review by public agencies and the Independent Māori Statutory Board, with revisions made based on feedback. The survey was available to participants in English and Te Reo Māori³.

The study sample for this research is drawn from the nationwide public housing tenancy list maintained by Kāinga Ora (the main provider of public housing in New Zealand). Primary tenants—those named on the tenancy agreement—were invited to participate in the wellbeing survey through an advertisement including information about the research project, details about a prize draw, a link to the online survey, and contact information for the research team. To reach potential participants, the advertisement was featured in the Kāinga Ora newsletters in June and September each year. These quarterly newsletters are distributed via mail to approximately 67,000 households and emailed to approximately 36,000 individuals. Additionally, in 2022, to increase visibility, physical copies of the advertisements were displayed in local Kāinga Ora offices throughout New Zealand and as a banner on the Kāinga Ora tenant website.

The survey was conducted annually in 2022, 2023, and 2024, with data from the first two waves analysed here. For the baseline survey in 2022, we achieved survey responses from 476 lead tenants, of which 436 completed the survey online and

² The twelve dimensions of the Living Standards Framework are: leisure and play, cultural capability and belonging, work, care, and volunteering, knowledge and skills, environmental amenity, subjective wellbeing, family and friends, engagement and voice, safety, health, housing, and income, consumption, and wealth.

³ A full guide to the survey and the development process is available separately (McPhee et al., 2023).

40 completed it via hardcopy. While the distribution list comprises approximately 65,000 lead tenants, it is not possible to determine the number of tenants that saw the advertisement in the newsletter, in Kāinga Ora offices, or on the Kāinga Ora tenant website. In the follow-up survey in 2023, we achieved survey responses from 761 lead tenants, of which 740 completed the survey online and 21 completed it via hardcopy. This included 285 participants who also completed the 2022 survey (64% of baseline cohort).

Table 1 below provides basic demographic information for the survey sample⁴. Although the response rate for the THHWBS is relatively low, the demographic composition of the respondents in Table 1 is broadly similar to Kāinga Ora tenants as reflected in administrative data (Annex 1, Table 6). For example, although the THHWBS sample is not gender balanced (81% female) this is consistent with the wider tenant group it is sampled from (79% of Kāinga Ora tenants are female). Despite broadly comparable demographics, the THHWBS is not based on a probability sample and it is likely that response to the survey is to some degree non-random. For example, the THHWBS sample is more likely to be unemployed than Kāinga Ora tenants overall (Annex 1, Table 6) reflecting, perhaps, that people without paid work may have more time to respond to the survey.

Method: Measuring Multi-dimensional Poverty

When considering wellbeing from a public policy context, a single measure of overall wellbeing is helpful because it allows for an answer to the question “will policy option A or policy option B lead to greater total wellbeing”. The most used measure of evaluative wellbeing – life satisfaction – is often applied precisely this context (e.g. Frijters & Krekel, 2021; Helliwell et al., 2023). Typically, this involves estimating a regression model with life satisfaction as the dependent variable and a range of demographic controls and potential determinants of wellbeing as independent variables. Such a model is illustrated in Eq. (1) below.

$$L_j = \beta_0 + \beta_D D_j + \beta_{X,n} X_j + \beta_Y Y_j + \epsilon \quad (1)$$

Here the life satisfaction of individual j is estimated as a function of the demographic characteristics of person j (D_j), a vector of potential determinants of wellbeing (X_j) and the income of individual j (Y_j). Within such a model the relative importance of two different policy options affecting different wellbeing outcomes can, in principle, be compared in terms of the relative size of the coefficients ($\beta_{X,n}$) of the relevant outcomes (Frijters & Krekel, 2021). In contrast, a multi-dimensional approach to conceptualising and measuring wellbeing does not provide an obvious intuitive criteria for making such judgements.

⁴ Respondents who were in both waves (285) have been included in the cross-sectional analysis. However dropping their responses from the second wave of the analysis has no substantive impact on the results with regression coefficients having the same sign and significance and similar absolute magnitudes. No panel data analysis of these respondents is included in this article.

Table 1 Sample demographics

Group	Proportion	Std Error	95% CI lower	95% CI upper
<i>Sex</i>				
Male	0.19	0.01	0.16	0.21
Female	0.81	0.01	0.79	0.83
Other	0.00	0.00	0.00	0.01
<i>Age</i>				
<25 years	0.02	0.00	0.02	0.03
25–34 years	0.12	0.01	0.10	0.14
35–44 years	0.20	0.01	0.18	0.23
45–54 years	0.22	0.01	0.20	0.25
55–64 years	0.23	0.01	0.21	0.26
65+ years	0.2	0.01	0.18	0.22
<i>Ethnicity</i>				
Maori	0.40	0.01	0.37	0.42
New Zealand European	0.58	0.01	0.55	0.61
Pacific	0.17	0.01	0.15	0.19
Asian	0.02	0.00	0.01	0.03
MELAA	0.02	0.00	0.01	0.03
Other ethnicity	0.01	0.00	0.01	0.02
<i>Labour force status</i>				
Paid work	0.18	0.01	0.16	0.21
Unemployed	0.21	0.01	0.19	0.24
Not in labour force	0.60	0.01	0.58	0.63
<i>Highest qualification</i>				
None	0.38	0.01	0.35	0.41
School qualification	0.35	0.01	0.32	0.38
Trade certificate	0.13	0.01	0.11	0.15
Bachelor's degree	0.09	0.01	0.08	0.11
Post graduate degree	0.06	0.01	0.05	0.07
<i>Disability status</i>				
Disabled	0.35	0.01	0.32	0.37
<i>Household income</i>				
\$10,000 or less	0.12	0.01	0.11	0.15
\$10,001–15,000	0.12	0.01	0.10	0.14
\$15,001–20,000	0.18	0.01	0.16	0.21
\$20,001–25,000	0.19	0.01	0.17	0.22
\$25,001–30,000	0.11	0.01	0.09	0.13
\$30,001–40,000	0.10	0.01	0.09	0.12
\$40,001–\$70,000	0.14	0.01	0.12	0.16
\$70,001–100,000	0.02	0.00	0.01	0.03
More than \$100,000	0.01	0.00	0.00	0.02
<i>Household size</i>				
Sole person	0.34	0.01	0.31	0.37
Two people	0.22	0.01	0.20	0.24
3 to 4	0.22	0.01	0.20	0.25
5 to 6	0.13	0.01	0.11	0.15
6 to 7	0.04	0.01	0.03	0.06
More than 8	0.05	0.01	0.04	0.07

Table 1 (continued)

Group	Proportion	Std Error	95% CI lower	95% CI upper
<i>Region</i>				
Auckland	0.41	0.01	0.39	0.44
Bay of Plenty	0.02	0.00	0.01	0.03
Gisborne	0.02	0.00	0.01	0.03
Northland	0.03	0.01	0.02	0.05
Wellington	0.11	0.01	0.09	0.13
Rest of North Island	0.17	0.01	0.15	0.2
Canterbury	0.17	0.01	0.15	0.19
Rest of South Island	0.06	0.01	0.05	0.08
<i>Migrant status</i>				
Migrant	0.15	0.01	0.13	0.17
<i>Household composition</i>				
Children in house	0.69	0.01	0.67	0.72
<i>Sample</i>	1,140			

A total of 97 responses have missing data and are omitted from the analytical dataset reported in Table 1. Analysis has been run with these results included and mean values imputed for missing data and results in no significant difference in analyses reported in this article. The THHWBS data is unweighted, and standard errors were estimated in STATA using Taylor linearised variance estimation. Note that ethnicities sum to greater than 1 as respondents are counted under all ethnicities with which they identify

To address this issue, we adapt the Alkire-Foster counting methodology (Alkire & Foster, 2011; Alkire et al., 2015) to provide a measure of the relative importance of different outcomes on multi-dimensional wellbeing. The Alkire-Foster counting methodology is an approach to measuring disadvantage in a situation where there are multiple distinct non-commensurable dimensions against which disadvantage needs to be evaluated. Disadvantage in a single dimension is defined with reference to a threshold (normatively determined) and the sum of dimensions in which a person experiences disadvantage is the person's deprivation score (Alkire et al., 2015). Multi-dimensional hardship occurs when a person experiences deprivation in a number of dimensions equal or greater than a (normatively determined) multi-dimensional hardship threshold.

More formally, disadvantage in wellbeing domain x for individual j ($d_{j,x}$) is a function of the individual's outcomes in that domain (X_j) and the deprivation threshold for that domain (t_x):

$$d_{j,x} = f(X_j, t_x) \quad (2)$$

The multi-dimensional deprivation score for an individual j (D_j) can then be calculated as:

$$D_j = \sum_{n=1}^x d_{j,x} \quad (3)$$

Similarly, multi-dimensional hardship is calculated as a function of a person's multi-dimensional deprivation score and a normatively-determined threshold (T) defining

the number of dimensions of wellbeing in which a person experiences deprivation which constitutes multi-dimensional hardship:

$$P_j = f(D_j, T) \quad (4)$$

While Alkire et al. (2015) focus on identifying metrics for assessing the incidence and intensity of multi-dimensional disadvantage, we propose a new metric for identifying the relative importance of a given dimension of wellbeing to overall wellbeing. In *An introduction to the principles of morals and legislation* (1780) Bentham defines the *fecundity* of an action as the degree to which an action causes further effects with the same utilitarian valance as the original action. Although Bentham's context is utilitarian, the concept of *fecundity* can be applied to assess the relative importance of different dimensions of wellbeing in the context of a multi-dimensional deprivation measure. In particular, we define the *fecundity* of a dimension of wellbeing as the mean number of additional dimensions of disadvantage experienced by an individual contingent on the person being disadvantaged in a specific dimension of wellbeing. Although not capturing any causal inference, *fecundity* provides an intuitive summary measure of the level of overall wellbeing associated with deprivation in any one area of wellbeing. Empirically, fecundity can be calculated as:

$$f_x = \bar{D}_j | (d_{j,x} = 1) - 1 \quad (5)$$

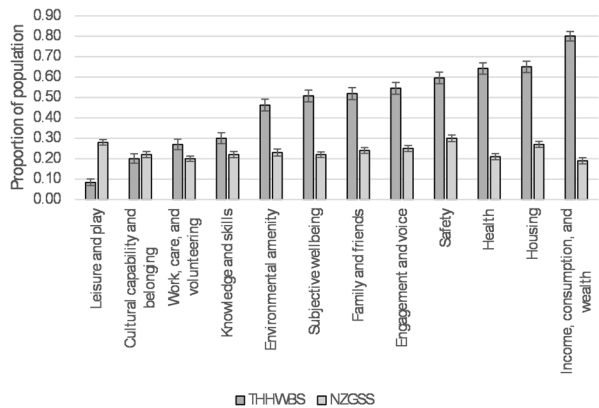
Where f_x is the *fecundity* of wellbeing dimension x , $\bar{D}_j$ is the mean multi-dimensional deprivation score for person x , and a value of 1 for $d_{j,x}$ indicates disadvantage in dimension x for person j . This provides a metric reflecting the association of disadvantage in a particular dimension of wellbeing with multiple disadvantage. An analogous *fecundity* measure for multi-dimensional hardship can be calculated as the change in the probability of experiencing multi-dimensional hardship given that a person experiences deprivation in wellbeing domain x where F_x is the fecundity measure for multi-dimensional hardship and $d_{j,x}$ and P_j are from Eqs. 2 and 4 respectively.

$$F_x = \frac{\partial P_j}{\partial d_{j,x}} \quad (6)$$

In calculating deprivation and multiple deprivation thresholds the distribution of outcomes in the NZGSS pooled over two waves (2021 and 2023) was used to identify deprivation thresholds (t_x) that represent approximately⁵ the bottom quintile of the New Zealand population. Similarly, the cut-off for the number of dimensions of wellbeing in deprivation that comprise multi-dimensional hardship (T) is

⁵ Because many of the outcome measures are captured on discrete Likert scales in many cases it is not possible to define a cut-off that captures exactly the bottom 20% of outcomes. In addition, although the cut-offs were selected with reference to a relative benchmark (the bottom 20% of the New Zealand population), the cut-offs are defined with reference to fixed values on the Likert scales and therefore are able to vary across population groups and over time.

Fig. 1 Proportion of the New Zealand total and social housing population experiencing disadvantage by dimension of wellbeing, THHWBS and NZGSS. Error bars correspond to 95%CI. Source: Te Hōtonga Hapori Wellbeing Survey, NZGSS 2021 and 2023



approximately equal to the bottom quintile of the total New Zealand population in the NZGSS in terms of multi-dimensional deprivation. Wellbeing dimensions were selected to reflect the New Zealand Treasury's Living Standards Framework (New Zealand Treasury, 2021; Hughes, 2021) which is explicitly grounded in the capabilities approach to multi-dimensional wellbeing and intended to inform public policy (Smith, 2018; Hughes, 2021). The indicators and thresholds for disadvantage used in this paper are found in Annex 2 (Tables 11 and 12).

The substance of this paper first reports disadvantage by wellbeing domain and then looks at the distribution of multiple disadvantage. Fecundity measures based on Eqs. (5) and (6) are reported for all twelve dimensions of disadvantage. These are then compared with the domain-specific coefficients on life satisfaction (β_x) from Eq. (1) to explore the degree to which the importance of different wellbeing domains is sensitive to the adoption of a multi-dimensional or subjective approach to measuring wellbeing. A measure of family wellbeing⁶ is also explored in place of life satisfaction as a further sensitivity test. The analysis is then repeated, focusing on fecundity values for indices capturing key features of the urban environment rather than for wellbeing domains⁷.

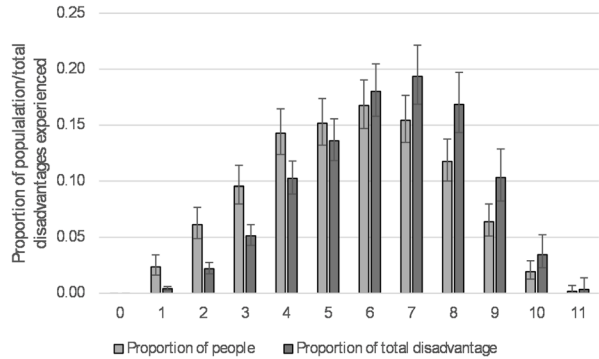
Results

Figure 1 below reports the proportion of the social housing tenants in the THHWBS experiencing disadvantage in each wellbeing domain of the Living Standards Framework alongside the equivalent measure for the total New Zealand resident population from the 2021 and 2023 waves of the NZGSS. Looking across the results from the THHWBS it is evident that there is a large degree of variation in deprivation across wellbeing domains for social housing tenants. The only dimension for which depri-

⁶The family wellbeing measure used here is a single item 11 point scale (0 to 10) asking the respondent about how their family is doing anchored at "extremely badly" and "extremely well". For a discussion of the question and its origins see Smith et al. (2025).

⁷In other words, we calculate the number of additional wellbeing dimensions in which an individual experiences disadvantage for a given change in different features of the urban environment.

Fig. 2 Distribution of multiple disadvantage among New Zealand social housing tenants. Error bars correspond to 95%CI. Source: Te Hōtonga Hāpori Wellbeing Survey



vation was lower for social housing tenants than for the New Zealand population was leisure and play – likely reflecting that social housing tenants include a high proportion of relatively time-rich retired people. In contrast, all the remaining wellbeing dimensions bar one (cultural capability and belonging) showed a much higher prevalence of disadvantage than was the case for the total population⁸. In the case of income, 80% of the social housing population had household incomes that would put them in the bottom quintile of the total population. The high levels of deprivation across different wellbeing domains found here for social housing tenants is unsurprising as family hardship is the main criteria for selection into public social housing in New Zealand.

Applying Eq. (3) to this data we produce a multi-dimensional deprivation score for each respondent as the count of the number of dimensions of wellbeing in which they are in hardship. Figure 2 illustrates the proportion of THHWBS respondents by deprivation score. It also shows the proportion of total deprivations accounted for by people at each deprivation score. Total deprivations, for this purpose, is the total number of people experiencing disadvantage in each wellbeing dimension summed across all twelve dimensions of wellbeing (i.e. ten people who are disadvantaged in one domain each count for the same proportion of total disadvantages as one person who is disadvantaged in ten wellbeing domains). The distribution of total disadvantage is rightward skewed compared to the distribution of people experiencing disadvantage.

It can be seen from Fig. 2 that almost none of the sample were entirely without disadvantage (i.e. had a disadvantage score of 0) and similarly there were no respondents who were disadvantaged in all 12 wellbeing domains. The modal disadvantage score was 6, which is relatively high, and reflects the fact that the sample population consists of people in social housing for which eligibility is heavily dependent on the experience of hardship.

To define multi-dimensional hardship – Eq. (4) – we apply a threshold that identifies the bottom quintile of the New Zealand population in the NZGSS in terms of the multi-dimensional deprivation score. This equates to a score of 5. Multi-dimensional

⁸ Although most of the hardship measures are derived from similarly constructed Likert scales there is relatively little correlation between the different dimensions of hardship. Each dimension in the wellbeing framework is capturing an empirically distinct phenomenon (see Table 9, annex 1).

hardship is therefore defined as experiencing disadvantage in 5 or more dimensions of wellbeing. As a sample of social housing tenants, the proportion of THHWBS respondents in multi-dimensional hardship is much higher (68%) than for the total New Zealand population. Although accounting for 68% of the THHWBS sample, people experiencing multi-dimensional hardship account for 82% of total disadvantages experienced across the twelve dimensions of the Living Standards Framework.

To explore the relative importance of each wellbeing dimension in the Living Standards Framework a fecundity measure is calculated as outlined in Eq. (5). This is reported in Table 2, column 1 (mean) and is the mean number of additional wellbeing dimensions in which a person is disadvantaged given that they are disadvantaged in the specified domain. For example, the mean additional dimensions of disadvantage for a person who experiences disadvantage in the health domain is 5.37. A person reporting disadvantage in the cultural capability and belonging domain, on the other hand, has a mean 6.07 additional wellbeing domains in disadvantage.

The two lowest-ranked domains in terms of mean fecundity are knowledge and skills and the income, consumption, and wealth domain. This might appear counter-intuitive given that these outcome areas are obviously important to material standard of living. Similarly, it is not a-priori clear that the two highest ranked wellbeing domains – cultural capability and belonging and leisure and play – would be more significant than, say, health or family and friends. This ranking – based on the mean fecundity score – is not based on the causal impact of each domain and is undoubtedly affected by the demographic composition of the sample. Retirees are both likely to have more free time (and therefore better outcomes in the leisure and play domain) and are also better off in other respects than other social housing tenants as New Zealand's retirement pension system is more generous than social assistance for working-age people. Similarly, there is relatively little variation in incomes within the

Table 2 Association between disadvantage by wellbeing domain and multiple disadvantage score, life satisfaction, and family wellbeing, THHWBS

Wellbeing domain	Fecundity Measure		Life Satisfaction	Family wellbeing
	Mean value	Regression	Regression	
	(1)	(2)	(3)	(4)
Income, consumption, and wealth	5.03	1.14***	-1.17***	-0.66***
Knowledge and skills	5.15	-0.04	0.14	0.34*
Health	5.37	1.16***	-1.59***	-1.26***
Safety	5.52	1.22***	-0.72***	-0.70***
Work, care, and volunteering	5.58	0.07	-0.35*	-0.09
Housing	5.68	0.69***	0.28+	-0.63***
Engagement and voice	5.78	1.45***	-1.5***	-1.65***
Subjective wellbeing	5.92	1.64***	-	-1.89***
Family and friends	5.93	1.62***	-1.92***	-
Environmental amenity	5.94	1.41***	-1.13***	-1.04***
Cultural capability and belonging	6.07	1.6***	-1.58***	-1.47***
Leisure and play	6.38	0.6**	-1.25***	-0.94**

Regression results: ordinary least squares with robust standard errors. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Omitted variables indicated with -

sample – who are almost entirely outside the labour market – and therefore variation in income, consumption, and wealth is less predictive of variation in other outcomes.

To control for these demographic associations, a second fecundity score was calculated based on regression analysis⁹ rather than a simple mean. Column 2 reports the regression coefficient associated with a dummy variable having a value of 1 if the person experiences disadvantage in that wellbeing domain and 0 otherwise, where the dependent variable is a person's multiple deprivation score dropping the domain being examined (e.g. for housing the dependent variable is the person's multiple deprivation score calculated without including housing indicators). Controls are included for sex, age, ethnicity, region, and survey wave¹⁰. The size of the coefficient can be taken as equivalent to a marginal fecundity score for deprivation in the wellbeing domain in question compared to the unconditional mean multiple deprivation score.

After controlling for demographic differences, the ranking of the different outcome areas in terms of multi-dimensional wellbeing alters significantly. Deprivation in knowledge and skills as well as work, care, and volunteering have no significant association with a person's multiple deprivation score. In contrast, income, consumption, and wealth moves from the second lowest place to 7th place while the three highest ranked outcomes are subjective wellbeing, family and friends, and engagement and voice.

Columns 3 and 4 of Table 2 report the coefficients in a series of regressions like those in column 2 but with life satisfaction (column 3) and family wellbeing (column 4) as the dependent variable. These results correspond to values for β_x in Eq. 1 for life satisfaction and an equivalent metric for family wellbeing and can be taken as reflecting the relative importance of each aspect of multi-dimensional wellbeing within a subjective wellbeing framework. A brief comparison of column 2 with values from columns 3 and 4 indicates that the coefficients are broadly similar in absolute magnitude and that there appears to be some degree of convergence in relative priorities. Values for life satisfaction in column 3 and family and friends in column 4 are omitted as the dependent variables (life satisfaction and family wellbeing) are used respectively in the definition of hardship in those wellbeing domains.

Figure 3 below illustrates graphically the relationship between the fecundity measure in column 2 of Table 2 (on the x-axis) and different subjective wellbeing measures (on the y-axis). While the rank ordering of different wellbeing domains differs between the fecundity measure and that taken from the two subjective measures considered below, the absolute magnitude of the coefficients is very similar and there is a clear linear relationship between them. Variation in fecundity accounts for 61%

⁹ The regression results reported here are ordinary least squares with robust standard errors since this provides coefficients that are linearly comparable to the mean values reported in Table 2, column 1. However, the analysis has been run with a binomial regression to reflect the nature of the fecundity measure as a bounded count and the results are not meaningfully different (Fig. 9, annex 1).

¹⁰ The fecundity measure is calculated without including the subjective wellbeing domain in order to exclude the possibility that the inclusion of life satisfaction as part of the multiple disadvantage score might be driving the similarities between columns 2 and 3. In fact, the results are robust to the inclusion or exclusion of both the subjective wellbeing and family and friends domains in the multiple disadvantage score (Fig. 6, annex 1).

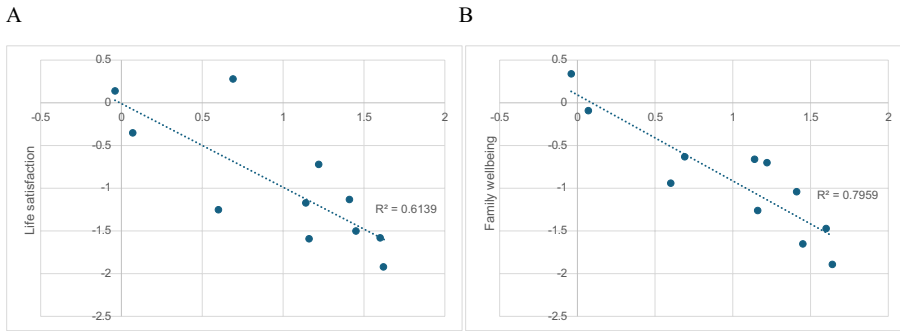


Fig. 3 Correlation between fecundity measure and life satisfaction (panel A) and family wellbeing (panel B). *x-axis: fecundity measure*

Table 3 Association between disadvantage by wellbeing domain and multi-dimensional hardship, low life satisfaction, and low family wellbeing, THHWBS

Wellbeing domain	Multi-dimensional hardship		Low life Satisfaction	Low family wellbeing
	Proportion	Regression	Regression	Regression
	(1)	(2)	(3)	(4)
Housing	0.69	1.27***	0.11	0.38**
Income, consumption, and wealth	0.75	1.53***	0.70***	0.52***
Knowledge and skills	0.77	0.62***	-0.06	-0.15
Health	0.81	1.66***	1.13***	0.91***
Work, care, and volunteering	0.82	0.93***	0.27+	0.24
Safety	0.83	1.93***	0.57***	0.52***
Environmental amenity	0.87	2.05***	0.63***	0.66***
Engagement and voice	0.88	2.15***	1.23***	1.35***
Family and friends	0.88	2.18***	1.61***	3.12***
Cultural capability and belonging	0.89	2.29***	1.22***	1.04***
Subjective wellbeing	0.91	2.38***	3.94***	1.52***
Leisure and play	0.95	1.63***	0.58*	0.43+

Regression results: logistic regression with robust standard errors. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$

of variation in life satisfaction and 79% of variation in family wellbeing. It is noteworthy that the two outliers driving down the correlation between fecundity and life satisfaction are housing quality and leisure given that the THHWBS sample consists of social housing tenants who have the same landlord and who are disproportionately likely to be retired. The strength of the correlation between the fecundity measure and each of the subjective measures is sensitive to the threshold defining a poor outcome (t_x), with the correlation remaining positive and significant but weakening when the hardship threshold is made more stringent (Annex 1, Fig. 7) and when the focus is moved to the top quintile (i.e. good outcomes) rather than the bottom quintile of the distribution (Annex 1, Fig. 8).

Table 3 further explores the relationship between multi-dimensional measures of wellbeing and subjective wellbeing by reporting fecundity measures based on the probability that the respondent is experiencing multi-dimensional hardship. Column 1 reports the probability that a person experiences multi-dimensional hardship con-

tingent on deprivation in each wellbeing domain based on Eq. (6). This generates only minor differences in rank ordering compared to Table 2, with large changes in ranking for only three outcomes (housing, environment, and subjective wellbeing). Column 2 reports an equivalent regression based multi-dimensional hardship fecundity score, controlling for demographic differences in the incidence of hardship across the different dimensions of wellbeing. The next two columns report the coefficients of a logistic regression treating life satisfaction and family wellbeing as dichotomous variables where low life satisfaction and low family wellbeing are defined as a score of 0 to 6 out of 10.

Broadly speaking the regression-based fecundity measures for multi-dimensional hardship in Table 3 are like those in Table 2 with a few minor exceptions. Figure 4 contrasts the regression fecundity measure for multi-dimensional hardship with the equivalent regression coefficients for low life satisfaction and low family wellbeing. As was the case in Fig. 3, there is a strong correlation between the fecundity measure and the relevant subjective wellbeing coefficients (R^2 of 0.69 for life satisfaction and 0.78 for family wellbeing).

Tables 2 and 3 demonstrate that fecundity measures can be calculated using similar data to that which underpins much analysis of the drivers of subjective wellbeing and that differences in the fecundity measure by wellbeing domain produce results that are broadly similar to those obtained using different measures of subjective wellbeing. However, it might be the case that this relationship is specific to social housing tenants or to the THHWBS survey itself. Table 4 below replicates Table 2 using data from the 2021 and 2023 waves of the NZGSS and is representative of the New Zealand population.

While the threshold defining hardship was selected so that the proportion of the total New Zealand population defined as experiencing hardship in each domain is as close to 20% as possible, the range of fecundity scores in column 1 remains wide (although the gap between the highest and lowest scores is, at 0.96, narrower than is the case for the THHWBS sample at 1.35). Looking across columns 2, 3, and 4, it is evident that the ranking of wellbeing domains for the general population is very similar when based on fecundity scores or on subjective measures. Figure 5 illustrates this in graphical form. Note that with the general population and the larger sample size of the NZGSS the alignment between fecundity measures and subjective measures increases compared to the THHWBS.

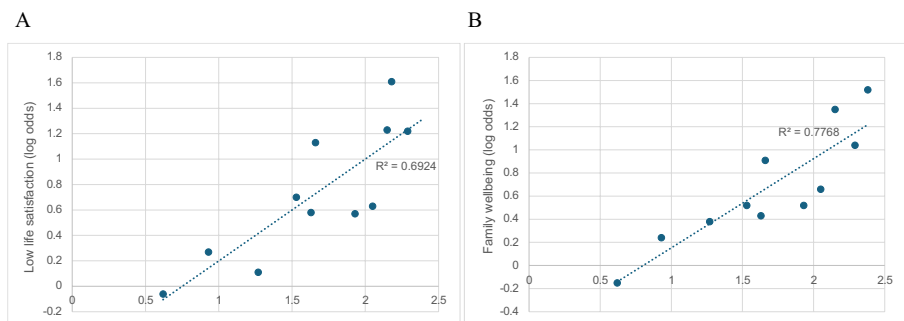
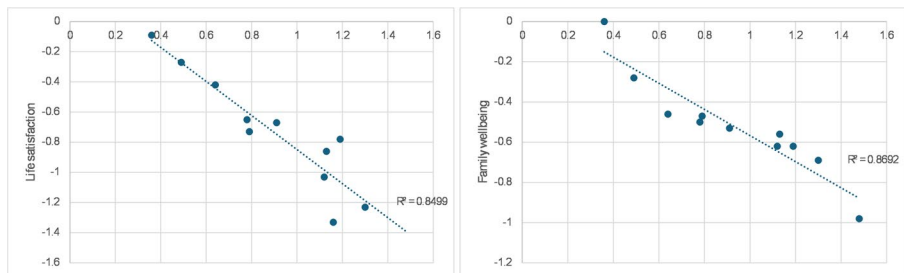


Fig. 4 Correlation between multi-dimensional hardship fecundity measure and life satisfaction (panel A) and family wellbeing (panel B). x-axis: fecundity measure

Table 4 Association between disadvantage by wellbeing domain and multiple disadvantage score, life satisfaction, and family wellbeing, NZGSS 2021 and 2023

Wellbeing domain	Fecundity measure		Life satisfaction	Family wellbeing
	Proportion	Regression	Regression	
	(1)	(2)	(3)	(4)
Knowledge and skills	3.73	0.36***	-0.09*	-0.00
Environmental amenity	3.86	0.49***	-0.27***	-0.28***
Safety	4.00	0.64***	-0.42***	-0.46***
Leisure and play	4.07	0.78***	-0.65***	-0.50***
Work, care, and volunteering	4.24	0.79***	-0.73***	-0.47***
Housing	4.33	0.91***	-0.67***	-0.53***
Income, consumption, and wealth	4.35	1.12***	-1.03***	-0.62***
Cultural capability and belonging	4.41	1.19***	-0.78***	-0.62***
Engagement and voice	4.43	1.13***	-0.86***	-0.56***
Health	4.50	1.3***	-1.23***	-0.69***
Family and friends	4.53	1.16***	-1.33***	-2.29***
Subjective wellbeing	4.69	1.48***	-2.72***	-0.98***

Regression results: ordinary least squares with robust standard errors. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$

**Fig. 5** Correlation between fecundity measure and life satisfaction (panel A) and family wellbeing (panel B), NZGSS 2021 and 2023. x-axis: fecundity measure

The analysis presented so far demonstrates that fecundity measures largely replicate the same broad patterns found with subjective measures while differing to some degree in the details and that this pattern is not unique to the sample of social housing tenants in the THHWBS since it is replicated in the NZGSS which has a robust national sample. This provides some evidence of convergent validity for fecundity measures. To explore whether the fecundity measure produces similar results to subjective wellbeing measures in a policy context we look at how different aspects of urban design affect wellbeing.

There are 11 questions relating to different aspects of urban design and neighbourhood characteristics in the THHWBS. These cover assessments of the dwelling and its location, connection to and residence in the neighbourhood, neighbourhood char-

Table 5 Association between urban design indices and multiple deprivation, life satisfaction, and family wellbeing

	Multiple disadvantage score (1)	Life satisfaction (2)	Family wellbeing (3)
Neighbourhood index	-0.36***	0.30***	0.22***
Dwelling index	-0.12**	-0.02	0.06
Residential ties index	0.09**	-0.00	0.04
Transport index	-0.13***	0.26***	0.19***

Regression results: ordinary least squares with robust standard errors. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$

acteristics, and access to services and transport locally¹¹. To explore the relationship between neighbourhood characteristics and wellbeing an exploratory factor analysis was undertaken on the 11 questions identifying four distinct factors relating to the dwelling and location, residential ties, neighbourhood characteristics, and transport (see Annex 1, Table 7).

Indices are constructed using the values from the factor analysis as weights corresponding to the four factors described above. Column 1 of Table 5 gives the regression fecundity measure – Eq. (5) – for each of the four indices while columns 2 and 3 report the coefficient on regressions with life satisfaction and family wellbeing respectively as the dependent variable. All regressions include controls for age, sex, ethnicity, region, and survey wave.

Table 5 presents a clear picture of the relationship between aspects of urban design and wellbeing. The neighbourhood index – which captures sense of community, pride in the look and feel of the neighbourhood, and whether the neighbourhood is a pleasant place to walk in – is associated with a lower multi-dimensional hardship score and an increase in both life satisfaction and family wellbeing. More specifically, a one standard deviation increase in the neighbourhood index is associated with a reduction in the number of dimensions in which a person experiences hardship of 0.8 and an increase in life satisfaction of 0.66 points and in family wellbeing of 0.6 points.

Access to services and the availability of public transport – as captured by the transport index – is also associated with the experience of hardship in fewer dimensions of wellbeing, higher life satisfaction, and higher family wellbeing. However, the effect size for the transport index is lower than for the neighbourhood index in the case of multi-dimensional hardship but about the same for life satisfaction and family wellbeing.

In contrast to the neighbourhood index and transport index, the dwelling index (capturing suitability of the dwelling itself, its location, and the outdoor characteristics of the dwelling) and the residential ties index (capturing years lived at the address, in the neighbourhood, and frequency of moves) have a significant association with multiple disadvantage but not with life satisfaction or family wellbeing.

¹¹ The eleven items are: (1) how suitable the location of the dwelling is; (2) how suitable the dwelling itself is; (3) how suitable the private outdoor space of the dwelling is; (4) years lived at the current address, (5) years lived in the neighbourhood; (6) number of times moved house in the past 5 years; (7) sense of community in the neighbourhood; (8) pride in the look and feel of the neighbourhood; (9) the neighbourhood is pleasant to walk in; (10) ability to meet everyday needs within a 20 min walk; and (11) satisfaction with public transport in the neighbourhood.

Interestingly, stronger residential ties are associated with more poor outcomes, perhaps reflecting that people living in social housing long term are likely to self-select for those whose outcomes do not improve. Similar qualitative results are obtained when the focus is on the probability of experiencing multi-dimensional hardship, low life satisfaction, or low family wellbeing (see Table 10, Annex 1).

Discussion

There are two broad categories of findings from this paper. The first of these relates to the relationship between urban design characteristics and the wellbeing of social housing tenants while the second focuses on the use of fecundity measures as a metric for assessing multi-dimensional wellbeing more broadly. While more space has been given to describing the nature and properties of the fecundity metric used here than has been to the relationship between urban design and wellbeing, both sets of findings are of interest.

The main substantive finding on urban design is the importance of neighbourhood characteristics and access to services or public transport for tenant wellbeing compared to a weaker association with dwelling characteristics or connection to the neighbourhood. These results are consistent with the wider literature on urban design and wellbeing (e.g. Das et al., 2022), are robust to whether wellbeing is considered in multi-dimensional terms or through subjective measures, and are also robust to whether wellbeing outcomes are framed in scalar or dichotomous terms. There are, however, two substantive differences between the multi-dimensional and subjective approaches to measuring wellbeing. The first is that neighbourhood characteristics have a larger relative weight when considered against multi-dimensional metrics than when considered against subjective measures. Interestingly there is no real difference in results for urban design characteristics when the subjective wellbeing measure used is changed from life satisfaction – which is individually focused – to the more collectively-oriented family wellbeing. Second, dwelling characteristics and residential ties have a significant association with multi-dimensional wellbeing but are not associated with either of the subjective measures used here.

The similarity of results between the multi-dimensional wellbeing measure and the subjective wellbeing measures is surprisingly strong when it is considered that all subjective measures were dropped from the multi-dimensional analysis. Although all of the measures used here are self-reports, and many are from Likert type scales, it is unlikely that shared method variance (Schneider & Schimmack, 2009) accounts for the correlation. Taken individually, correlation between the individual wellbeing domains is low (Table 9, Annex 1) as is correlation between subjective wellbeing and other wellbeing domains.

There are, nonetheless, two important limitations relating to the findings on urban design. First, the sample population is limited to a self-selected sample of social housing tenants who are likely to have different needs to the general population. This does not make the findings less relevant to policy: it is important to understand how urban design affects tenant wellbeing when planning social housing developments. However, it does suggest caution in generalising the findings to the rest of the popula-

tion. The second limitation is that because all the respondents have the same housing provider – Kāinga Ora – their dwellings are likely to have shared characteristics. If true, this could bias estimates of the association between dwelling characteristics and wellbeing. There is some evidence supporting this in that the variance of the dwelling index is smaller than that for the neighbourhood index, but it remains larger than is the case for the residential ties index or transport index (Table 8, Annex 1) suggesting that this is unlikely to be the main factor driving the results.

While the substantive results identified in this paper are of interest, the potential for fecundity measures to identify relative priorities between different outcomes in the context of multi-dimensional wellbeing is also important. Multi-dimensional wellbeing measures have several important strengths from both a conceptual and practical viewpoint. Conceptually, multi-dimensional wellbeing measures align naturally with wellbeing frameworks widely used internationally such as the capabilities approach (Sen, 1993) and with many indigenous frameworks (e.g. Durie 2004; Smith et al., 2025). Practically, the use of multi-dimensional measures of wellbeing ensures that the different aspects of wellbeing are considered explicitly and any trade-offs or disparities between outcomes in dimensions are transparent. Also, it is important to note that a multi-dimensional approach to measuring wellbeing may have greater political traction than subjective approaches with multi-dimensional “dashboards” dominating in formal national wellbeing measurement initiatives (Grimes, 2021; Brandt et al., 2022; Mahoney, 2023).

Several authors have commented on the difficulty of moving from a multi-dimensional wellbeing framework to policy priorities (e.g. Grimes, 2021; O’Connor, 2023). Where subjective wellbeing measures offer a simple metric for assessing the importance of different outcomes in terms of the size of their effect on life satisfaction (Frijters et al., 2020; Frijters & Krekel, 2021; Grimes, 2021), this is not the case for multi-dimensional frameworks. The Alkire/Foster multi-dimensional counting method is one of the few attempts to provide a systematic framework for applying a multi-dimensional wellbeing framework to public policy. When the variables used to construct a multi-dimensional poverty measure are, themselves, continuous (e.g. income, life expectancy) then the Alkire/Foster approach can produce a scalar wellbeing metric in terms of depth of multi-dimensional poverty (Alkire & Foster, 2011). However, if some of the dimensions included in the calculation of multi-dimensional poverty are ordinal – such as most Likert scales – calculating a poverty depth measure is not possible (Alkire & Foster, 2011; Alkire et al., 2015). While it is still possible to count the number of wellbeing dimensions in which a person experiences deprivation (the multi-dimensional deprivation score), this metric, on its own, provides no information about the relative importance of the different dimensions of wellbeing.

The approach presented here – based on the concept of fecundity measures – uses the multi-dimensional deprivation score to produce a scalar measure of the relative association between each wellbeing domain and multi-dimensional poverty by looking at the degree to which disadvantage in the dimension under consideration is associated with greater or lesser levels of deprivation in other dimensions. Fecundity measures have three attractive properties.

First, they have an intuitive interpretation that makes sense from a practical policy perspective. Fecundity measures capture the number of additional dimensions of hardship that a person experiences conditional on being in hardship in one specific

dimension. Such measures thus direct attention directly to those outcomes associated most strongly with wellbeing across multiple dimensions and which are, *ceteris paribus*, likely to be those outcomes associated with a high proportion of public cost.

In addition to having clear reason to be valued, fecundity measures also produce results which are plausible when tested against other wellbeing metrics. Examining the rankings and weights produced for social housing tenants from fecundity measures shows similar results to those obtained from looking at subjective wellbeing measures such as life satisfaction. This relationship is even stronger in a high quality representative sample of the total New Zealand population (the NZGSS). Taken together these results provide evidence of convergent validity for such measures.

Finally, fecundity measures are more robust to the type of data used than is the case for depth measures of multi-dimensional hardship. This is particularly important when it is considered that many of the dimensions of wellbeing that commonly feature in national wellbeing frameworks such as social contact are typically measured through Likert scales from household general social surveys (Fleischer et al., 2016) and do not meet the criteria for the production of a depth measure of multi-dimensional hardship.

The analysis presented here is focused on a narrow population: social housing tenants in New Zealand. This is not an issue for the relevance of the substantive policy findings, but it is possible that the broader findings on the performance of fecundity measures – particularly their convergence with the results of subjective wellbeing analysis – are specific to the population group and dataset considered here.

There are some good reasons to believe that the alignment between fecundity measures and subjective wellbeing measures is not dataset specific. In particular, the fact that convergence between fecundity measures and subjective measures is stronger for the general population in the NZGSS than for the THHWBS sample suggests that the result is not sample- or survey-specific. There is also good evidence that the dimensions of multi-dimensional wellbeing frameworks are correlated with subjective wellbeing measures (Anand et al., 2009; Boarini et al., 2013). However, exploration of how fecundity measures perform in the context of other datasets containing multi-dimensional wellbeing measures (e.g. The European Social Survey, the European Quality of Life Survey, various national household social surveys) would be valuable.

The use of fecundity as a metric does not, in any final sense, resolve the tension between the multi-dimensional and subjective approaches to wellbeing. This distinction is fundamentally conceptual and philosophical: it is grounded in differing views of what wellbeing “is”. In contrast, the correlation between fecundity measures and wellbeing domain weights based on subjective wellbeing measures identified here is contingent and empirical. Although the fecundity measures presented here produce results very similar to subjective wellbeing domain weights in both the THHWBS and the NZGSS, some differences in these weightings remain and can be seen in the analysis of urban design and wellbeing presented here. What this paper does is to address a practical gap in the use of multi-dimensional wellbeing measures to inform public policy by providing a conceptually attractive and empirically grounded approach to weighting different aspects of wellbeing within a multi-dimensional wellbeing framework. Although the analysis presented here is preliminary, and focuses primarily on issues of urban design, fecundity has potential as an alternative approach to prioritising wellbeing outcomes in a policy context.

Annex 1

Table 6 Demographics of Kāinga Ora tenants, NZGSS and administrative data

Group	THHWBS	NZGSS (Kāinga ora tenants)
<i>Sex</i>		
Male	0.19	0.23
Female	0.81	0.79
Other	0	N/A
<i>Age</i>		
<25 years	0.02	0
25–34 years	0.12	0.05
35–44 years	0.2	0.2
45–54 years	0.22	0.29
55–64 years	0.23	0.26
65+ years	0.2	0.23
<i>Ethnicity</i>		
Maori	0.4	0.36
New Zealand European	0.58	0.74
Pacific	0.17	0.27
Asian	0.02	0.02
MELAA	0.02	0.01
<i>Labour force status</i>		
Paid work	0.18	0.4
Unemployed	0.22	0.06
Not in labour force	0.59	0.56
<i>Highest qualification</i>		
None	0.38	0.43
School qualification	0.35	0.39
Trade certificate	0.13	0.11
Degree and above	0.15	0.07
<i>Disability status</i>		
Disabled	0.35	0.24
<i>Household income</i>		
0 to \$30,000	0.72	0.49
\$30,001 to \$ 70,000	0.24	0.24
\$70,001 to \$100,000	0.02	0.11
\$100,001 or more	0.01	0.16
<i>Region</i>		
Auckland	0.41	0.39
Bay of Plenty	0.02	0.06
Canterbury	0.17	0.14
Gisborne	0.02	0.04
Northland	0.03	0.04
of North Island	0.17	0.18
of South Island	0.06	0.05
Wellington	0.11	0.14

Source: THHWBS and the New Zealand General Social Survey. Note that ethnicities sum to greater than 1 as respondents are counted under all ethnicities with which they identify

Table 7 Urban design characteristics: factor loadings

	Neighbour- hood index	Dwelling index	Connection index	Access Index	Unique- ness
Variable	Factor1	Factor2	Factor3	Factor4	
Location suitable	0.1906	0.5195	0.1233	0.4205	0.5018
Dwelling suitable	0.1798	0.6775	-0.0685	0.196	0.4655
Outdoor area suitable	-0.4012	-0.5611	0.1024	0.0127	0.5136
Years lived at address	0.0282	-0.0432	0.6936	-0.1413	0.4963
Years lived in area	-0.1501	-0.0215	0.6613	0.0777	0.5337
Number of moves in last 5 years	-0.2422	-0.1755	-0.1234	0.1531	0.8719
Neighbourhood sense of community	0.503	0.2937	0.0063	0.2353	0.6053
Neighbourhood pride	0.7896	0.1962	-0.0799	0.0532	0.3288
Neighbourhood pleasant	0.7417	0.092	0.003	0.2146	0.3953
Neighbourhood access	0.3428	0.2312	-0.1457	0.5688	0.4842
Public transport satisfaction	0.2543	0.2251	-0.0498	0.4628	0.668
Commuting time	-0.0158	-0.1032	0.0057	-0.0467	0.9869

Table 8 Summary statistics for urban design indices

Index	Observations	Mean	Std Dev	Variance	5% quantile	95% quantile
Neighbourhood	1,130	5.61	2.21	4.89	0.03	9.77
Dwelling	1,128	3.17	1.70	2.88	-1.61	5.42
Residential tenure	1,138	4.86	1.81	3.28	1.35	6.77
Transport	1,125	6.58	2.07	4.28	0.99	9.57

Table 9 Correlations between hardship measures

	Leisure and play	Engagement and voice	Safety	Cultural capability and belonging	Environmental amenity	Health	Housing	Knowledge and skills	Income, consumption, and wealth	Family and friends	Work, care, and volunteering	Subjective wellbeing
Leisure and play	1											
Engagement and voice	0.04	1										
Safety	0.06	0.17	1									
Culture & belonging	0.03	0.25	0.17	1								
Environmental amenity	0.08	0.19	0.24	0.25	1							
Health	0.05	0.18	0.14	0.17	0.1	1						
Housing	0.04	0.04	0.12	0.17	0.21	0.03	1					
Knowledge and skills	-0.12	0.07	0.03	-0.04	-0.01	0.03	-0.03	1				
Income, consumption, and wealth	0.04	0.14	0.05	0.11	0.12	0.1	0.09	0.02	1			
Family and friends	0.07	0.26	0.19	0.34	0.21	0.22	0.13	-0.11	0.15	1		
Work, care, and volunteering	0.17	0.08	0.01	0.06	0.06	-0.1	0.02	-0.04	0.08	0.06	1	
Subjective wellbeing	0.09	0.29	0.16	0.29	0.16	0.3	0.03	-0.03	0.15	0.35	0.01	1

Fig. 6 Correlation between fecundity measures with and without subjective wellbeing omitted

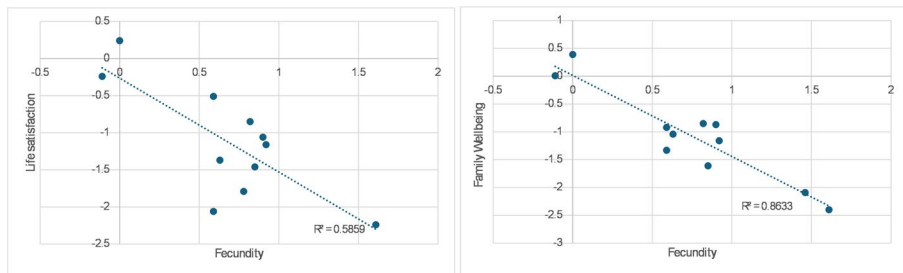
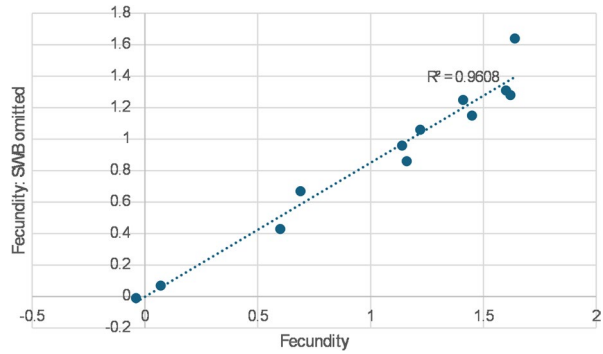


Fig. 7 Correlation between fecundity measure and life satisfaction (panel A) and family wellbeing (panel B), THHWBS: high hardship threshold

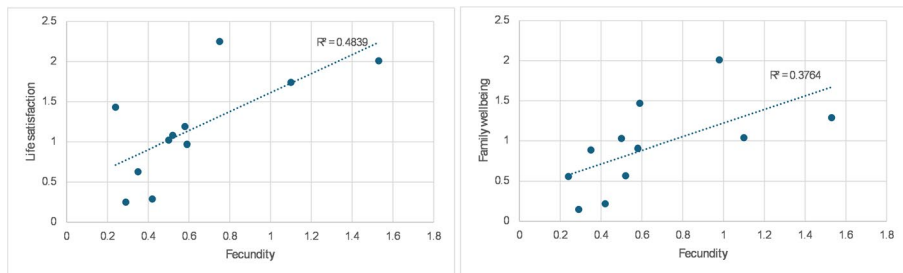


Fig. 8 Correlation between fecundity measure and life satisfaction (panel A) and family wellbeing (panel B), THHWBS: top quintile of outcomes

Fig. 9 Correlation between fecundity measure coefficients: OLS vs GLM binomial regression

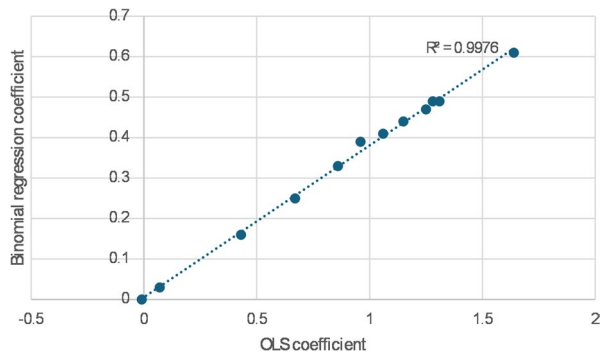


Table 10 Association between urban design features and multi-dimensional hardship, low life satisfaction, and low family wellbeing

	Multi-dimensional hardship (4)	Low life satisfaction (5)	Low family wellbeing (6)
Neighbourhood index	-0.42***	-0.15***	-0.16***
Dwelling index	-0.15*	-0.05	-0.04
Residential ties index	0.11**	-0.01	-0.06
Transport index	-0.14***	-0.16***	-0.13***

Regression results: logistic regression with robust standard errors. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$

Annex 2. Questions and Thresholds

Table 11 Te Hotonga Hapori wellbeing survey questions

Topic	Descriptor
Demography (10 Questions)	Gender, Household Composition/Size, Age, Place of Birth, Descent (Māori), Highest Qualification, Ethnicity
Work (5 Questions)	Employment Status/Hours/Pattern/Satisfaction/Work-Life Balance
Views and Perceptions (4 Questions)	Feel About Life, Life Worthwhile, Locus of Control, Life Satisfaction
Health (10 Questions)	Self-rated Health, Disability, Physical Activity
Identity, Culture, Language (3 Questions)	Ability to Express Identity, Use of Te Reo Māori, Accessibility to Māori Culture
Māori (6 Questions)	Ancestral Marae, Marae Visit, Connection to iwi, Importance of Culture, Iwi – Region, Iwi – Tamaki Makaurau
Society in NZ (2 Questions)	Generalised Interpersonal Trust, Volunteering/Participation in communities
Safety & Security (2 Questions)	Neighbourhood Safety, Anti-social Behaviour
Whānau, Family & Social Connectedness (4 Questions)	Whānau wellbeing, Loneliness, Social Support
Housing (10 Questions)	House Condition, House/Location/Outdoor Space Suitability, Length of Stay (House/Neighbourhood), Housing Security, Reasons for Moving, Prior Neighbourhood Connection.
Neighbourhood (9 Questions)	Sense of Community, Sense of Pride, Walkability, Public transport, 20-min Neighbourhood, Improvement, Location of Workplace/Education, Travel Mode, Commute Time
Natural Environment (2 Questions)	Importance of health of Natural Environment, Quality of Natural Environment
Standard of Living (3 Questions)	Material Standard of Living, Household Income

Table 12 Hardship thresholds by domain of wellbeing

Wellbeing domain	Indicator thresholds defining hardship
Knowledge and skills	No high school qualifications beyond NCEA level 1 (year 11) and no post-school qualifications.
Work, care, and volunteering	Unemployed or not satisfied or very satisfied with job
Leisure and play	Not satisfied or very satisfied with work/life balance
Subjective wellbeing	Life satisfaction of less than 6 or expected life satisfaction in 5 years time less than 7
Health	Health status poor or fair or disabled at WGSS-3.
Culture, capability and belonging	Not easy or very easy to be yourself or cannot speak te reo Māori very well
Engagement and voice	Trust in others is less than 7 and not volunteering or trust is less than 5
Safety	Feels very unsafe or unsafe walking alone at night and 1 or more neighbourhood problems or does not feel very safe or safe walking alone at night and 3 or more neighbourhood problems
Family and friends	Lonely at least a little of the time and family wellbeing less than 8
Housing	Immediate or immediate and extensive repairs needed and not always cold or always cold
Environmental amenity	Not satisfied or very satisfied with quality of the natural environment
Income, consumption, and wealth	Income not enough or only just enough and total HH income \$100,000 or less

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Declarations

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