Wellbeing recovery inequity following the 2010/2011 Canterbury earthquake sequence: repeated cross-sectional studies

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Abstract

Objective: To track population mental wellbeing following the 2010/2011 Christchurch earthquakes and after-shocks.

Methods: The Canterbury Wellbeing Survey, a cross-sectional survey of randomly selected adults aged ≥18 years resident in Christchurch, was repeated biannually from April 2013 until June 2017 and annually thereafter. The self-reported 5-item World Health Organization Well-Being Index (WHO-5) has been elicited from April 2013. Regression analysis was employed to model WHO-5 score patterns over time and between important socio-demographic groups.

Results: Between 1,137 and 1,482 adults participated in each survey, totalling 14,100 overall. The mean WHO-5 significantly increased ($p<0.001$) from 52.4 (95% confidence interval [CI]: 51.1, 53.8) in the April 2013 survey to 60.8 (95%CI: 59.7, 61.9) in the June 2019 survey. A significant and sustained household income group disparity existed ($p<0.001$), even when adjusting for age, gender and ethnic differences.

Conclusions: The disaster appeared to affect the mental wellbeing of all, and recovery was incremental and prolonged, taking a number of years. Those within the lowest household income group had lower mean WHO-5 scores than their wealthier counterparts at every measured time point.

Implications for public health: Recovery takes time, and pre-existing inequities persist despite the implementation of recovery processes aimed at mitigating these risks.

Key words: mental health, epidemiology, disaster recovery, adults, inequalities

Poverty and widening income inequity are important public health issues, since both are associated with poorer health and wellbeing outcomes for both individuals and society.[1,2] Pre-existing socioeconomic conditions influence capacity to respond to significant life events such as natural disasters, in both the short and long term,[3-5] through factors including ability to prepare or evacuate, degree of local infrastructure development, and access to material resources.[6,7] Additionally, those who are socioeconomically disadvantaged may face greater physical exposure to natural disaster risk by virtue of where they live.[8]

In September 2010, a series of devastating earthquakes and aftershocks struck the Canterbury region on the east coast of New Zealand's South Island.[9] The most damaging single event was an M6.3 aftershock on 22nd February 2011, which caused 185 deaths – the majority of which were as a result of the collapse or partial collapse of two multi-storey office buildings.[10] The Canterbury earthquakes caused substantial damage to the region with the total construction cost of the rebuild estimated at $NZ40 billion in 2016, close to 20% of New Zealand's annual gross domestic product.[11] Christchurch was especially affected by the February 2011 aftershock, which was centred 6.7 kilometres south-east of its city centre.[9,10] The city centre remained cordoned off, to a gradually reducing extent, until June 2013; a total of 859 days.

More than 90% of greater Christchurch's housing stock was damaged by the earthquakes, and large residential areas (an estimated 7,860 residential properties) with extensive, area-wide land damage were designated Residential Red-Zone (RRZ) by the New Zealand Government.[12] These areas were where residents faced an unacceptable level of life risk and where an engineering solution to mitigate it would be uncertain and disruptive, could not be done in a timely way and was not cost-effective.[13] In the RRZ areas, the government offered to purchase properties from their owners. Socioeconomically disadvantaged areas were disproportionally affected by the earthquakes, with damage and liquefaction more prevalent in low-lying areas such as Bexley, New Brighton, Dallington and other areas in the north-east of the city.[13] This is visually depicted in Figure 1(a), which presents a geo-spatial map of Christchurch by deprivation decile derived from the Census prior to the earthquake. Figure 1(b) presents

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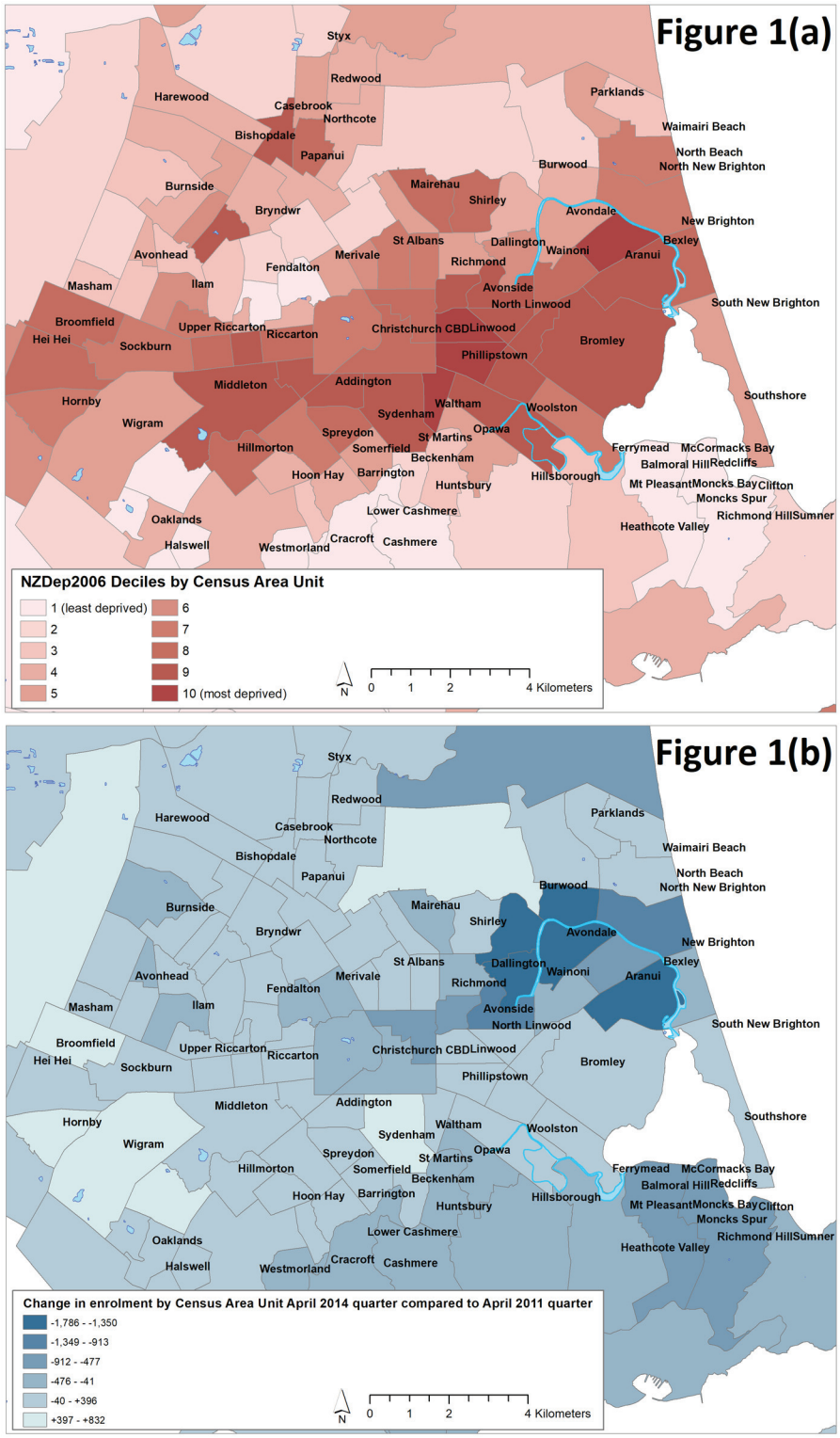
the changes in primary health organisation (PHO) enrolments between the April 2011 quarter and April 2014 quarter. These figures forcefully demonstrate the population movements post-disaster due to the RRZ, damaged buildings and infrastructure, and other factors.

A new, time-limited government department, the Canterbury Earthquake Recovery Authority (CERA), was established in March 2011 to lead and coordinate the government's earthquake recovery efforts.[14] When CERA was disestablished in 2016, a number of existing or newly established agencies took on responsibility for the aspects of CERA's work that were to continue.[14] This included the Canterbury District Health Board (CDHB), which was delegated responsibility for ongoing social monitoring and psychosocial recovery. The Ministry of Building Innovation and Employment, through the Greater Christchurch Claims Resolution Service, had responsibility for overseeing the remainder of the private housing insurance claims, including those related to 'onsold' properties and re-repairs. Those with unsettled insurance and Earthquake Commission (EQC) claims continued to show significantly poorer wellbeing status in the monitoring data until 2017.[15] Community wellbeing was recognised as being of fundamental concern throughout the post-earthquake period.

Figure 1: (a) Geo-spatial map of greater Christchurch by deprivation decile derived from the 2006 Census prior to the earthquake; (b) changes in primary health organisation (PHO) enrolments between the April 2011 quarter and April 2014 quarter.



Methods

Study design

The CWS is a cross-sectional survey, which was repeated biannually from September 2012 until June 2017 and annually thereafter. The 5-item World Health Organization Well-Being Index (WHO-5) scale was introduced in April 2013, limiting this study's timeframe from April 2013 to June 2019.

Target population

Adults aged ≥18 years with a residential address within the Christchurch City (excluding Banks Peninsula) region and registered on the New Zealand electoral roll

Systematic monitoring of wellbeing is important at total population level, but particularly for those parts of the population with pre-existing vulnerabilities.[5] The CERA Wellbeing Survey (CWS, known since 2016 as the Canterbury Wellbeing Survey once handed over to the CDHB) was developed by a CERA-led multiagency working group in 2011–2012.[16] The CWS has been conducted at least annually since September 2012, with the purpose of monitoring social recovery especially in terms of subjective wellbeing and direct impacts of the earthquakes. The time series created by the CWS presents a unique opportunity to track a large, predominately urban population as it recovers from a series of earthquakes, overall and by important sociodemographic groups. The study aims to investigate changes over time, and to ascertain whether particular subgroups carry a disproportionately heavy mental health burden relative to their peers.

were eligible to participate. People were excluded if they were residents but had not registered on the electoral roll or were ineligible to register (e.g. temporary migrant workers), or if they had recently relocated to Christchurch but had not updated their electoral roll details.

Outcome measure: current mental wellbeing

Introduced in 1998, the WHO-5 is a short, cost-free self-reported measure of current mental wellbeing.[17] The WHO-5 consists of five simple and non-invasive questions, which respondents rate according to a six-point scale ranging from 0 (at no time) to 5 (all of the time). These scores are summed and then multiplied by 4 to give the final score, with 0 representing the worst-imaginable wellbeing and 100 representing the best. The WHO-5 has high clinimetric validity and has been applied successfully across a wide range of populations and study fields.[18]

Explanatory variables

Gender was ascertained by asking 'Are you …?' with female and male response options, until 2016 when a gender diverse option was added. Age was elicited with the question: 'In which of the following age groups do you belong?' with response options in 5-year intervals from 20–24 years until 60–64 years, with additional categories 18–19 years, 65–74 years, and 75+ years. These were collapsed into the age bands employed here. Aligned with the recommended method of reporting in New Zealand, multiple ethnic identifications were permitted.[19] Ethnic identification was asked via 'Which ethnic group or groups do you belong to? (Please circle all that apply)' with options: New Zealand European; New Zealand Māori; Pacific; Asian; Indian; Other (please specify); and Prefer not to say. However, for the regression analyses, ethnicity was recoded using a single priority classification for those with multiple identifications,[20] with Māori having priority coding, followed by Asian, New Zealand European (labelled Pākehā), and Other. Household income, in New Zealand dollars (NZD), was elicited with 'Which best describes your household's annual income before tax?' with options: Loss; No income; ≤$30,000; $30,001 to $60,000; $60,001 to $100,000; >$100,000; Don't know; and Prefer not to say. The New Zealand Index of Deprivation 2006 for Christchurch City (excluding Banks Peninsula) was extracted from Statistics New Zealand.[21] It is based on the deprivation characteristics of 'meshblocks' (small areas with a typical population of 60–110 people), and combines 2006 Census data relating to income, home ownership, employment, qualifications, family structure, housing, access to transport and communications into a single measure. Each meshblock is assigned a score from 1 (least deprived) to 10 (most deprived), with 10% of all meshblocks being in each category.

Procedure

A detailed description of the procedures appears in each Canterbury Wellbeing Survey Report (see: https://www.cph.co.nz/your-health/wellbeing-survey/).[22] Nielsen, a global measurement and data analytics company, has been charged with conducting the surveys from inception. There have been minor changes to the instrument over time (e.g. the WHO-5 was first introduced in April 2013). The most recent report explicitly details all changes made.[23] In brief, probabilistic random sampling was applied, stratified by region (Christchurch City including Banks Peninsula, targeted to include n=1,250 adults), age group, gender and Māori/non-Māori ethnic groups. Males, those aged 18–24 years, and Māori respondents were oversampled to ensure sufficient representation. A sequential approach was adopted whereby selected adults were first encouraged to complete the survey online. For those who failed to complete the survey online or were not able to, a hard copy questionnaire was provided. Both online and hard copy questionnaires had been piloted prior to the first survey administration. An initial invitation letter was posted, which contained a link to the online survey and provided an individual login ID and password. An 0800 telephone number (a cost-free service) and email address were also included, allowing those selected to ask questions about the survey, request a hard copy or request to be removed. A reminder postcard was sent a week later to those who had not yet completed the survey. This postcard repeated the instructions for completing the survey online. A week after the postcard, those respondents who had still not completed online were sent a survey pack, containing a hard copy questionnaire, cover letter and reply paid envelope. The cover letter also repeated the instructions to participate online, in case that was preferred. Two weeks later, a final postcard was sent to those who had still not completed the survey. The survey was closed four weeks later. Response rates have ranged from 34% (September 2015) to 48% (April 2013),[23] with an average of 39.2%, and have not systematically changed over time (linear regression, p=0.25). The final databases were then securely transmitted to the CDHB for archiving and further analysis.

Statistical analysis

Reported methods and results were informed by the STROBE guidelines (www.strobe-statement.org).[24] All data were held on a secure CDHB computer, with only the non-identifiable output shared between investigators. Stata SE version 16.0 (StataCorp, College Station, TX) was employed for all statistical analyses and the drawing of the connected line plot, and α=0.05 defined significance. Unweighted frequencies were reported, but all other estimates (including percentages) were weighted by age, gender and ethnic identification. Weights were derived from Census population figures, sourced from Statistics New Zealand. Crude and adjusted linear regression analyses were used to model mean WHO-5 scores over time for the income groups. Both main effect and two-factor interaction terms were investigated, and the adjusted Ward's type III test used to derive associated p-values.

Ethics

University of Canterbury Human Ethics Committee approval for the CWS was obtained once it was handed over from CERA to the CDHB (HEC 2017/20/LR-PS). When first developed in 2012, the study was peer reviewed by the Massey University Ethics Committee, reflecting the then Survey Working Group membership, and was deemed to fall into the low ethical risk category, therefore not requiring formal review. Only those who provided informed consent were included in the study.

Results

Demographics

The raw frequencies and weighted percentages of the survey respondents' demographics over each included survey measurement wave are included in Table 1. Due to the study design and weightings, the distributions are relatively consistent over time – although only 50 Māori participated in the September 2015 survey compared to 121

in the May 2018 survey. What these relatively stable demographic characteristics mask is the substantial population displacement after the 2011 February aftershock (see: Figure 1(b))

Wellbeing

Overall, participants' mean wellbeing score, as measured by the WHO-5, increased from 52.4 (95%CI: 51.1, 53.8) in the April 2013 survey to 60.8 (95%CI: 59.7, 61.9) in the June 2019 survey. The annual average increase in mean WHO-5 scores was 1.55 (95%CI: 1.36, 1.74, $p<0.001$). When considering a quadratic model over time, the second order time component was not significant ($p=0.37$) and omitted henceforth.

Household income and wellbeing

The distribution of household income over measurement waves also appears in Table 1. Overall, 14.6% of the sample reported household incomes ≤$30,000, 20.6% reported incomes between $30,001 and $60,000, 23.2% reported incomes between $60,001 and $100,000, 25.5% reported incomes >$100,000, and 16.1% of participants had an undeclared household income. Figure 2 presents the connected line plot of these weighted mean WHO-5 scores over measurement waves, partitioned by the household income classifications for those with declared income. A clear separation in mean WHO-5 scores is apparent in Figure 2 between those within the ≤$30,000 and >$100,000 household income groupings, while those with household income between $30,001 and $100,000 generally had intermediate mean WHO-5 scores.

Regression analyses

After accounting for the increasing mean WHO-5 scores over measurement waves, weighted linear regression confirmed the significant household income differences observed in Figure 2 ($p<0.001$). Respondents with household incomes of $30,001–$60,000, $60,001–$100,000, and >$100,000 had mean WHO-5 scores on average 4.3 (95%CI: 2.9, 5.6), 5.2 (95%CI: 3.9, 6.4), and 8.2 (95%CI: 6.9, 9.4) higher, respectively, than those respondents with household incomes of ≤$30,000. No significant interaction between these household income groupings and time ($p=0.08$) was observed, suggesting that the gap in mean WHO-5 scores between household income groups remained largely unchanged over the study period.

In unadjusted analyses, the considered participant demographic characteristics of gender ($p<0.001$), age ($p<0.001$), and prioritised ethnic identification ($p<0.001$) were all significantly associated with mean WHO-5 scores after accounting for its change over time. Males, those aged 65–74 years, and those identifying as Asian had relatively higher mean WHO-5 scores; whereas females, those aged 35–49 years, and those identifying as Māori had relatively lower scores. Table 2 includes the weighted linear regression estimates of mean WHO-5 score differences and associated 95% CIs between these groupings.

Finally, an adjusted analysis was conducted, relating household income groupings to the mean WHO-5 scores, accounting for gender, age, prioritised ethnic identification and the changes over time. The significant difference between household income groups and mean WHO-5 scores was maintained ($p<0.001$), as were the effects associated with gender ($p<0.001$), age ($p<0.001$) and ethnic identification ($p<0.001$); see Table 2. As observed within the unadjusted analyses, when the interaction between household income groupings and time was introduced

Table 1: Observed frequencies and weighted percentages (w) of the participants' demographic characteristics over the survey measurement waves.

	Apr. 13	Sept. 13	Apr. 14	Sept. 14	Apr. 15	Sept. 15	Apr. 16	Sept. 16	Jun. 17	May 18	Jun. 19
	n (w)	n (w)	n (w)	n (w)	n (w)	n (w)	n (w)	n (w)	n (w)	n (w)	n (w)
Gender											
Female	622 (52.1)	735 (51.9)	661 (51.5)	740 (51.3)	708 (51.0)	631 (51.0)	791 (51.5)	595 (50.9)	672 (51.3)	826 (51.5)	735 (50.9)
Male	554 (47.9)	481 (48.1)	591 (48.5)	624 (48.7)	592 (49.0)	551 (49.0)	630 (48.4)	538 (48.7)	594 (48.5)	653 (48.3)	558 (48.8)
Gender diverse	N/A	N/A	N/A	N/A	N/A	N/A	2 (0.1)	4 (0.3)	4 (0.3)	3 (0.2)	5 (0.3)
Age (years)											
18-24	204 (14.8)	219 (14.9)	105 (13.7)	211 (13.9)	162 (13.7)	156 (14.0)	174 (12.7)	152 (13.9)	181 (13.9)	209 (13.7)	173 (13.9)
25-34	168 (13.9)	149 (12.5)	111 (10.9)	184 (13.1)	192 (14.6)	177 (14.7)	181 (13.2)	126 (11.7)	179 (12.9)	218 (13.7)	184 (14.7)
35-49	350 (29.3)	369 (30.8)	327 (32.2)	423 (29.7)	380 (28.7)	349 (28.4)	410 (29.9)	336 (31.3)	408 (30.1)	457 (29.3)	358 (28.4)
50-64	247 (23.6)	273 (23.6)	388 (24.1)	302 (24.2)	313 (24.0)	286 (23.9)	365 (24.6)	288 (24.0)	298 (23.8)	328 (24.0)	328 (23.9)
65-74	110 (9.7)	104 (9.2)	177 (10.6)	151 (11.8)	139 (10.4)	123 (11.0)	167 (11.2)	135 (11.1)	118 (11.0)	153 (10.8)	141 (10.6)
75+	97 (8.7)	102 (9.0)	144 (8.6)	93 (7.3)	114 (8.6)	91 (8.0)	126 (8.4)	100 (8.1)	86 (8.3)	117 (8.5)	114 (8.5)
Ethnic identification[a]											
Pākehā	1,025 (87.3)	1,079 (88.6)	1,117 (88.7)	1,235 (90.5)	1,151 (87.7)	1,047 (87.8)	1,261 (87.6)	998 (87.2)	1,089 (86.3)	1,262 (85.6)	1,128 (86.6)
Māori	73 (6.4)	72 (6.3)	75 (6.4)	80 (6.2)	60 (6.2)	50 (6.1)	74 (6.6)	59 (6.3)	100 (6.9)	121 (6.7)	74 (5.9)
Asian	38 (3.1)	77 (6.1)	66 (5.8)	72 (5.1)	90 (7.0)	86 (7.1)	91 (6.5)	93 (8.3)	104 (8.1)	146 (9.9)	105 (8.4)
Other	93 (7.8)	36 (2.9)	35 (3.0)	35 (2.6)	39 (3.0)	32 (2.7)	39 (2.9)	34 (3.1)	41 (3.1)	40 (2.8)	42 (3.2)
Household income (NZD)[b]											
≤$30,000[c]	192 (16.6)	189 (15.7)	248 (17.5)	217 (16.1)	193 (15.1)	187 (16.1)	187 (13.0)	173 (14.9)	152 (12.9)	174 (12.0)	150 (11.4)
$30,001-$60,000	260 (22.2)	257 (21.5)	263 (20.9)	285 (21.0)	264 (20.2)	235 (20.1)	303 (21.2)	242 (20.8)	240 (19.3)	306 (20.7)	249 (19.2)
$60,001-$100,000	273 (23.4)	317 (26.4)	286 (23.3)	324 (23.6)	317 (24.4)	286 (23.6)	336 (23.9)	241 (21.4)	320 (24.4)	316 (21.3)	258 (19.9)
>$100,000	275 (23.4)	236 (19.1)	260 (21.9)	328 (24.0)	321 (24.4)	279 (23.1)	384 (27.2)	307 (27.5)	337 (25.7)	440 (29.6)	421 (32.8)
Unknown[d]	176 (14.5)	217 (17.3)	195 (16.4)	210 (15.3)	205 (16.0)	195 (17.1)	213 (14.7)	174 (15.5)	221 (17.7)	246 (16.4)	220 (16.8)

Notes:

a: Respondents are permitted to have multiple ethnic identifications thus summed percentages may exceed 100%

b: weighted by age, gender and ethnicity

c: includes those with loss or no income

d: includes 'prefer not to say' and 'don't know' responses.

within this model, its effect was non-significant (p=0.11).

Discussion

Post-disaster, Christchurch's residents have had an incremental and prolonged mental wellbeing recovery, as measured by the WHO-5. This speaks to the need for the long-term monitoring of psychological consequences.[5] The improvement demonstrated here is also consistent with improvements seen in other subjective wellbeing measures within the CWS, such as overall quality of life and stress.[15] However, the large differences in mean WHO-5 scores between household income groups at baseline (April 2013) have largely persisted throughout the time series. The lack of a significant interaction between household income groupings and time suggests that these differences have been largely unaltered as the earthquake recovery has progressed. The endurance of the differences in the adjusted analysis indicates that they were not due to confounding by gender, age or ethnicity and likely to be systemic issues associated with enduring inequalities.[1] Indeed, these WHO-5 data replicate and reinforce the well-established picture of stratification of health and wellbeing outcomes elsewhere; in this case, self-reported emotional wellbeing by income.[1,25] This led Phibbs and colleagues to coin the Inverse Response Law;[26] the idea that people in disadvantaged groups are more likely to be impacted and to experience disparities in service provision during the disaster response and recovery phase. They propose that vulnerable groups struggle to compete for necessary services create inequities in adaptive capacity as well as in social and wellbeing outcomes over time.[26]

The large population displacement, and associated insurance and EQC claim issues[27] – disproportionately affecting those in the more deprived areas – likely exacerbated the mental wellbeing demands of many Christchurch residents. Many residents found the disaster itself easier to deal with than the processes associated with the recovery and rebuild.[13] This was despite government and local authorities recognising the risk of recovery processes exacerbating pre-existing inequities, and attempting to proactively mitigate against these inequities.[13,14] However, the inequitable wellbeing outcomes observed here partly resulted from the political priority action primarily focused

Figure 2: Connected line plot of weighted mean WHO-5 scores for participants over time by household income (NZD) classification.

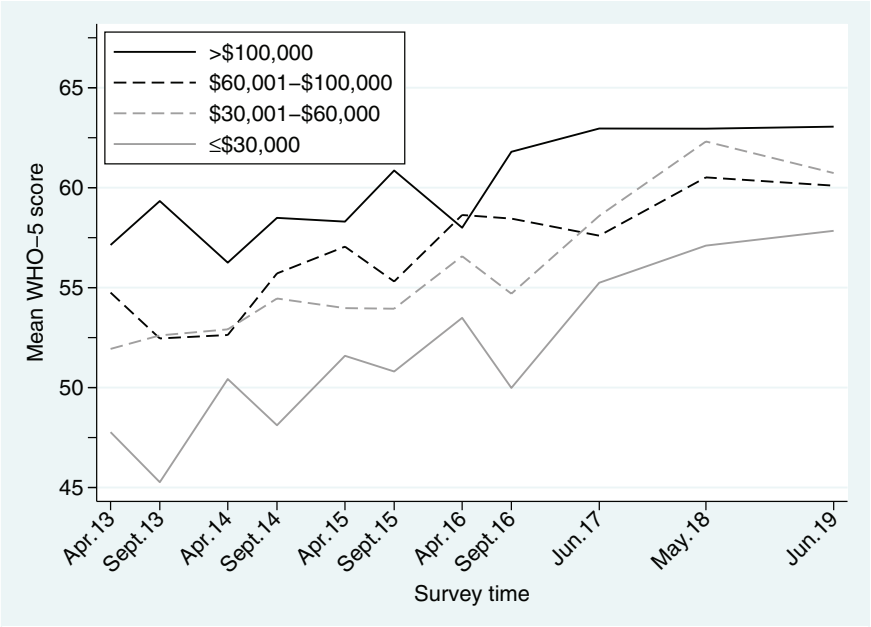


Table 2: Unadjusted and adjusted weighed linear regression estimates and associated 95% confidence intervals of mean WHO-5 scores differences over the survey measurement waves.

	Unadjusted[e]		Adjusted[f]	
	est.	(95%CI)	est.	(95%CI)
Time (in years since April 2013)	1.55	(1.36, 1.74)	1.39	(1.19, 1.58)
Gender[a]				
Female	0	(reference)	0	(reference)
Male	2.6	(1.8, 3.3)	2.1	(1.4, 2.8)
Age (years)				
18-24	2.2	(1.1, 3.3)	4.3	(3.1, 5.4)
25-34	1.8	(0.7, 2.9)	2.2	(1.1, 3.3)
35-49	0	(reference)	0	(reference)
50-64	0.4	(-0.6, 1.4)	1.2	(0.2, 2.2)
65-74	5.5	(4.2, 6.8)	9.0	(7.6, 10.3)
75+	0.8	(-0.8, 2.5)	5.5	(3.8, 7.3)
Prioritised ethnic identification[b]				
Pākehā/Other	0	(reference)	0	(reference)
Māori	-2.7	(-4.3, -1.1)	-1.9	(-3.4, -0.3)
Asian	1.9	(0.6, 3.3)	3.7	(2.3, 5.0)
Household income (NZD)				
≤$30,000[c]	0	(reference)	0	(reference)
$30,001-$60,000	4.3	(2.9, 5.6)	5.2	(3.9, 6.5)
$60,001-$100,000	5.2	(3.9, 6.4)	7.4	(6.1, 8.7)
>$100,000	8.2	(6.9, 9.4)	10.9	(9.5, 12.2)
Unknown[d]	2.9	(1.4, 4.3)	3.9	(2.4, 5.4)

Notes:

a: gender diverse respondents omitted due to the small number of respondents in this category

b: participants with multiple ethnic identifications were recoded using a priority classification, with Māori first, followed by Asian, and then Pākehā/Other

c: includes those with loss or no income

d: includes 'prefer not to say' and 'don't know' responses

e: adjusted for time

f: adjusted for time and all the variables in Table 2.

replacing what had been destroyed.[13,28] This begs the question: Is it possible to implement recovery policies that reduce pre-existing inequity? The Sendai Framework for Disaster Risk Reduction has a stated goal to 'build back better' and references the importance of broad-based collaboration to achieve this goal.[29] While conceptually appealing, a review of three case studies (which includes the aftermath of the Christchurch earthquakes) reveals its complexities and challenges – despite worthy intentions.[25]

It was notable that females, those aged 35–49 years, and those identifying as Māori had relatively lower mean WHO-5 scores. It has been found that the psychological wellbeing of women is more at risk during disasters, as they are at greater risk of violence and sexual abuse, diseases and psychological trauma than men.[30-32] However, it has been argued that research has tended to focus on women rather than men following disasters, and there are limited analyses of the broader perceptions and personal experiences of impacted men.[33] Working-age adults have been identified as at being risk elsewhere,[34] as they are likely to be responsible for children and be financially exposed through house and business ownership mortgages. Māori people in New Zealand carry a disproportionate health burden, having greater neighbourhood deprivation and less advantage across all measured socioeconomic indicators, and experiencing more racial discrimination than non-Māori.[35] Moreover, it has been argued that social sensitivities were not fully understood by CERA in their rapidly developed planning processes, increasing the vulnerability of cultural risk to Māori communities in particular.[28] For example, the land zoning decision-making threatened Māori culture, language, and tūrangawaewae – "the importance to the stature of men and women of the land on which they stand, of the place they are entitled to call their own".[13]

This study has both strengths and weaknesses. Strengths include the relatively large, representative survey, consistently implemented by a professional company using best practice methods.[23] The consistent and repeated use of the psychometrically robust WHO-5,[18] which avoided pathologising of the survey sample and wider population that could contribute to secondary stressors,[36] was also a strength. Primary limitations included the repeated cross-sectional design, rather than longitudinal, meaning that individual change (over time) could not be measured. Also, the response rate (ranging from 34% to 48%) is likely to introduce participant bias, although the sample weighting is likely to mitigate its impact. The household income measurement was not adjusted for household composition, as this was not captured in the survey questionnaire. This is likely to dampen effect size differences and suggests that the reported findings between groups may be underestimated. Finally, and importantly, no population-level WHO-5 data for adults were available either for Christchurch city pre-earthquake or, until recently, for elsewhere in New Zealand. Consequently, it has not been possible to benchmark mental wellbeing as measured in the CWS against pre-earthquake measures in greater Christchurch, or against other regions. However, a 2018 survey of 6,894 residents from eight New Zealand cities (Auckland, Hamilton, Tauranga, Hutt, Porirua, Wellington, Christchurch, and Dunedin) found Christchurch's respondents had raw mean WHO-5 scores that were slightly above the eight-city average, but lower than those in Tauranga, Hutt, and Porirua.[37] This suggests that by 2018, some seven to eight years after the earthquake sequence, the Christchurch city population, as a whole, may have recovered.

Conclusions and implications

Community mental wellbeing recovery takes many years following a disaster, and pre-existing inequities persist despite the implementation of recovery processes aimed at mitigating these risks. In the haste for recovery, important groups can be excluded or left behind, deepening their mental wellbeing effects. An inclusive framework that recognises and privileges the diverse needs of communities requires development and implementation if recovery is to be shared by all.

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