Monitoring wellbeing during recovery from the 2010-2011 Canterbury Earthquakes: the CERA Wellbeing Survey

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Abstract

In this paper we outline the process and outcomes of a multi-agency, multi-sector research collaboration, led by the Canterbury Earthquake Research Authority (CERA). The CERA Wellbeing Survey (CWS) is a serial, cross-sectional survey that is to be repeated six-monthly (in April and September) until the end of the CERA Act, in April 2016. The survey gathers self-reported wellbeing data to supplement the monitoring of the social recovery undertaken through CERA's Canterbury Wellbeing Index. Thereby informing a range of relevant agency decision-making, the CWS was also intended to provide the community and other sectors with a broad indication of how the population is tracking in the recovery. The primary objective was to ensure that decision-making was appropriately informed, with the concurrent aim of compiling a robust dataset that is of value to future researchers, and to the wider, global hazard and disaster research endeavor. The paper begins with an outline of both the Canterbury earthquake sequence, and the research context informing this collaborative project, before reporting on the methodology and significant results to date. It concludes with a discussion of both the survey results, and the collaborative process through which it was developed.

1. Introduction

In 2010 and 2011, a sequence of destructive earthquakes caused 185 deaths, thousands of injuries and extensive building and land damage in the city of Christchurch, New Zealand. In order to oversee the recovery from this disaster, a new government department, the Canterbury Earthquake Recovery Authority (CERA), was established on the 1st May 2011. In this paper we outline the process and outcomes of a multi-agency, multi-sector research collaboration, led by CERA. The CERA Wellbeing Survey (CWS) is a serial, cross-sectional survey that is to be repeated six-monthly (in April and September) until the end of the CERA Act, in April 2016. Including central and local government, academic and other research organisations, and Ngāi Tahu, the local indigenous tribal organization, this collaboration benefited from the goodwill and cross-sectoral activity stimulated by the urgency of the response phase. Gathering wellbeing data from representative samples of the population affected by the earthquake sequence, the CWS project has both policy and research objectives. By collecting data that were not routinely collected by agencies, this project provides self-reported wellbeing data to supplement the monitoring of the social recovery undertaken through CERA's Canterbury Wellbeing Index. Thereby informing a range of relevant agency decision-making, the CWS was also intended to provide the community and other sectors with a broad indication of how the population is tracking in the recovery. The primary objective was to ensure that decision-making was appropriately informed, with the concurrent aim of compiling a robust dataset that is of value to future researchers, and to the wider, global hazard and disaster research endeavor. This paper begins with an outline of both the Canterbury earthquake sequence, and the research context informing this collaborative project, before reporting on the methodology and significant results to date. It concludes with a discussion of both the survey results, and the collaborative process through which it was developed.

1.1 Context

1.1.1 *The Canterbury Earthquake Sequence*

The Canterbury Earthquakes began with the 7.2 M_W 'Darfield' earthquake on the 4th September 2010. This damaging seismic sequence was then punctuated by a further three larger events as it trended eastward beneath the city of Christchurch (Figure 1).

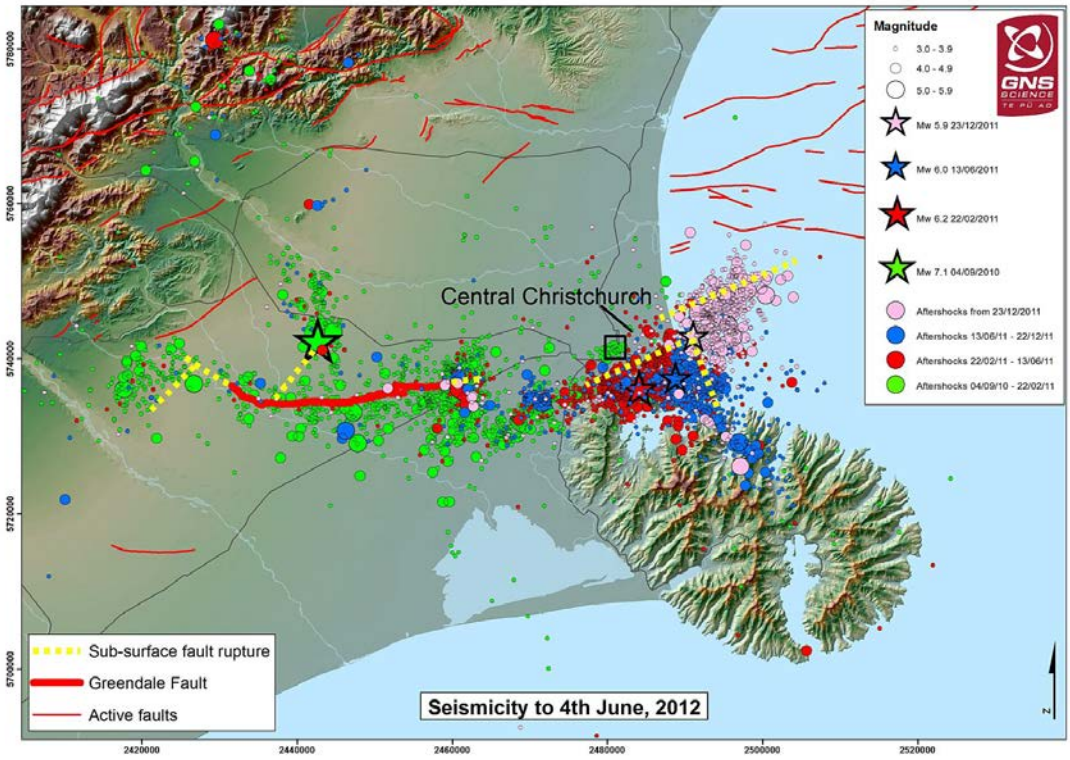


Figure 1: The Canterbury earthquake sequence from 4th September 2010 – 4th June 2012

The second and most destructive of these events occurred on the 22 February 2011, when a Mw 6.3 'Christchurch' earthquake directly under the city's southeastern suburbs produced very high vertical ground acceleration in the central and eastern city suburbs. This second major event caused widespread damage and lead to 185 deaths and over 6,500 injuries. The third and fourth of the larger events, on 13th June (M_w 6.2) and 23rd December 2011 (M_w 6.2), respectively, were less disruptive, although they compounded liquefaction and damage effects (King et al., 2014).

Damaging tens of thousands of homes across the city, this sequence also resulted in such severe damage to the 2,000 commercial buildings in the central business district (CBD) that more than half are likely to require demolition, including a significant number of heritage buildings (Chang et al., 2014). Widespread liquefaction throughout the eastern suburbs, particularly in the February 2011 earthquake, ejected 500,000 tonnes of silt, and caused severe damage and disruption to road networks and aging, buried infrastructure networks, compromising water, electricity and sewage systems (Rogers et al., 2014; van Ballegooy et al., 2014). The total cost of recovery and reconstruction has been estimated at as much as NZ$40 billion, with the cost equivalent to around 19% of New Zealand's GDP (New Zealand Treasury 2013; Stevenson et al., 2014).

The scale of this disaster, and the response and recovery operations, led to the declaration of the first state of national emergency in New Zealand, which lasted for two months. It was followed by the passing of the Canterbury Earthquake Recovery Act 2011. Establishing CERA as a purpose-built government agency of limited duration, this act provided the new authority with a range of powers designed to reduce obstacles to recovery decision-making (Johnson & Mamula-Seadon, 2014).

Approximately 80% of the losses caused by the earthquake sequence were covered by insurance, with this disaster involving more than 500,000 related residential claims (for

building, land and contents) from approximately 160,000 dwellings, and more than 30,0000 non-residential claims (King et al., 2014) National insurance cover is provided in New Zealand by the Earthquake Commission (EQC), a crown entity that works with private insurers to cover residential property against loss or damage caused by a range of natural hazards, including earthquakes (*Earthquake Commission Act*, 1993; Johnson & Mamula-Seadon, 2014). This arrangement contributed to high levels of residential insurance, but also to the complexity of claim management (King et al., 2014; Chang et al., 2014). Since EQC cover was capped at NZ $100,000, and cover for claims above that cost reverted to the private insurer, claims at or around the cap often required negotiation with both EQC and private insurers (Chang et al., 2014).

As a result of the extensive land damage caused by liquefaction and slope stability hazards in some areas of the city, the government categorized over 7,500 residential properties (~5% of total housing stock) as too difficult, uneconomic, dangerous and/or impractical to repair (Rogers et al., 2014). Those with houses zoned 'red' on this basis were able to engage with a Government offer process, which provided eligible homeowners in these zones with the opportunity to relocate (Rogers et al., 2014).

1.1.2 *Research context*

The importance of 'evidence-based' decision making has come to prominence over the past 15 years, as democratic governments have responded to an increasingly complex and fragmented policy-making environment with increased reliance on non-state expertise for resources and cooperation (Gluckman 2013; Skogstad 2003; 2005; Jasanoff 2012). Policy and decision-makers are more likely to base decision-making on research findings if they have been involved in all phases of the research process (Cash et al., 2003). The need to base policy on evidence is understood to be particularly important during recovery from major disaster events, when denominators can be changeable and uncertain (Chang, 2010). Recovery has been defined as the return to an acceptable level of stability, though not necessarily equivalent to pre disaster conditions (Quarantelli, 1999). In the CERA context, recovery is defined as "both restoration and enhancement" (CERA 2012). Within these broader views of recovery, psychosocial recovery, which is estimated to take 5-10 years, is defined as "being when people and communities have established a relatively stable pattern of functioning, regained a sense of control and are orientated towards their future" [?ref for this quote–from Jane's rebuttal notes]. The Canterbury Wellbeing Index and CERA Wellbeing Survey use nationally comparative data and/or pre- and post-earthquake baseline data to enable recovery agencies to monitor progress against achieving an acceptable level of stability. Figure 2 illustrates how a community may respond to a disaster over time, however each scenario is inevitably different and this is especially the case in Canterbury, due to the duration and severity of the earthquake sequence.

Figure 2. Phases of response to a disaster over time
Source: California Department of Mental Health (2012, reproduced by Britt et al 2012, p 33).

Recent studies in the US and elsewhere indicate, however, that research focused on disaster recovery is comparatively scarce (Shelton et al., 2012; Bidwell, 2011). Of 1,593 disaster-related health research projects federally funded in 2009-2010 in the US, for example, only 9% were concerned with recovery (Shelton et al 2012). Moreover, there is no common robust framework for measuring recovery (Chang 2010). Routinely collected data, which are most frequently used to monitor recovery, have advantages of availability, continuity over time (including pre-event data) and coverage of affected and un-affected areas, enabling regional and national comparisons. While providing a useful broad evidence base, however, such data do not provide an adequate picture of the progress of recovery. Disaggregated data are not always readily available, and aggregated data can hide inequities, which have been shown to be increased by disasters (Chang, 2010). In addition, denominators are particularly uncertain following a disaster, a problem that was exacerbated in the case of Canterbury by a two-year delay in the national Census as a direct result of the February 2011 earthquake. In any case, it has been well established that the most difficult aspects of recovery to measure are direct impacts of the event, psychosocial wellbeing and perceptions of the recovery, including the performance of recovery agencies (Bidwell, 2011).

Wellbeing has been defined as "the dynamic process that gives people a sense of how their lives are going, through the interaction between their circumstances, activities and psychological resources or "mental capital"' (New Economics Foundation, 2014). Measures of wellbeing, in particular, cannot be adequately derived from routinely collected data. Measures of negative outcomes, such as psychiatric morbidity, for example, are poor proxies for emotional wellbeing, as they do not consider the positive aspects of wellbeing, such as adequate role functioning (at home, school or work), and satisfactory quality of life (Norris et al., 2008). This is consistent with the World Health Organization definition of health (WHO 1948), which considers health in terms of the presence of (physical, mental and social) wellbeing, rather than just the absence of disease or infirmity.

Validated health and wellbeing scales have been used in surveys in disaster-affected communities, in particular the Short-Form 36 (Sabucedo, 2010; Chou et al., 2004) and General Health Questionnaire (Toyabe et al., 2007; Tapsell & Tunstall, 2008) Some surveys

have also sought to establish symptomatology or diagnoses (Sabucedo et al 2010, Adams & Boscarino, 2005; Verger et al., 2003), to determine respondents' exposure to the event (Chang 2009, Verger et al 2003) and/or to determine prior adverse experiences and level of functioning (Adams and Boscarino 2005). However, apparently 'recovered' populations, as assessed by prevalence of psychiatric morbidity, may still be significantly negatively affected in ways not discerned by a diagnostic approach (Norris et al 2008).

New surveying to monitor recovery has several advantages. The sampling frame can be tailored to the particular need, and surveys allow - resources permitting - sufficient numbers for disaggregation by characteristics of particular interest (for example geographical sub-region, age, ethnicity and socioeconomic status). Surveys can also be used to address questions specific to the event and to the stage of recovery, including measuring positive aspects such as quality of life, resilience, and social connectedness. Representative samples can address the high mobility of post-disaster populations by providing an up to date sample at a given point in time.

2. Methods:

Upon establishment, CERA and partner agencies identified the need for a monitoring framework that would enable evidence-based decision-making through the recovery. A series of workshops with central and local government agencies and representatives of relevant academic sectors aimed to establish a social outcomes framework for recovery, to identify the potential indicators and data sources available to track progress against this framework, and to ensure that the methodology and content were robust and legitimate.

A 'long-list' of potential indicators based on existing administrative and survey data from government departments was analyzed against a set of criteria drawn from recovery literature. Indicators were selected for consistency over time and between regions, relevance, timeliness, accessibility and validity.

The resulting Canterbury Wellbeing Index enables monitoring of such areas as housing affordability and availability, uptake of psychosocial services, educational achievement, population movement, labour market movement, and health.

During the process of developing the Index it became evident that self-reported wellbeing data formed a large gap in the available datasets. Available recovery literature confirmed that gathering such data is necessary in order to monitor the social progress of recovery. This literature, and the circumstances of the recovery in Greater Christchurch, also indicated that the resulting data-set would constitute a valuable resource for researchers. The long running Quality of Life (QoL) survey across six New Zealand cities was available to provide some baseline wellbeing data, although the boundaries were a subset of those specified by the CERA Act for recovery monitoring. In addition to the provision of baseline data, the inclusion of key QoL wellbeing questions in the CWS has enabled comparisons with trends in the other five cities.

2.1 *Questionnaire development*

A working group led by CERA developed the survey questionnaire (questionnaire development is illustrated in Figure 3). The composition of the working group reflected the Government's statutory partners: the three local territorial authorities and the local Māori tribe, as well as bringing in key non-statutory partner organisations. Researchers from the

Christchurch City Council (CCC), Selwyn District Council (SDC), and the Waimakariri District Council (WDC) represented relevant local authorities. The Canterbury District Health Board (CDHB) representative liaised with the health community to provide public health and bio-statistical expertise, while also representing this government health agency. A Natural Hazards Research Platform representative similarly liaised with the hazard and disaster research community; as the national hazard and disaster research consortium, the NHRP had been tasked with supporting agencies involved in response and recovery after natural hazard events. The Ngāi Tahu representative ensured that the project gathered data relevant to Ngāi Tahu recovery needs. CERA also worked across central government recovery partners from the arts, culture and sports sectors to ensure that gaps in their data collections could be addressed where possible to meet the future needs of their recovery activities.

A succession of workshops was held to identify and refine survey content. This process was driven by the information needs of the operationally focused partner agencies, as well as the need to ensure that the process and outcomes of the project were scientifically valuable. Input was also sought and received from other agencies involved in recovery activities. The CWS working group was cognisant of its responsibility to minimise the burden on respondents, and focused on survey content was directly applicable to agency information needs.

The questionnaire included: socio-demographic questions, including full address and – if different – address before the earthquake sequence (for geocoding purposes); questions from the existing Quality of Life Survey chosen as measures of wellbeing and social cohesion (overall Quality of Life, stress, sense of community); and questions regarding impacts of the earthquakes (both negative and positive); communications and (confidence in) decision-making around the earthquakes; and about respondents' knowledge of psychosocial services provided as part of the recovery operation. Question selection was determined by gaps in the Canterbury Wellbeing Index data, suitability of Quality of Life Survey questions, and the operational needs of recovery agencies. Individual questions and the questionnaire as a whole were considered in terms of acceptability and potential burden on an already-vulnerable population.

The questionnaire was set up with the aim of making it possible to be reviewed at each time-point, so that changes could be made. It was anticipated, and has been the case, that these would be predominantly additions rather than altering existing questions, to ensure comparability with other time-points. For example, new questions regarding positive impacts, such as access to new and newly repaired facilities, have been made in the third and fourth waves of the survey to reflect changing stages of progress into the recovery. This evolution of questionnaire content is consistent with other post-disaster questionnaires (Carr et al 1997) and reflects the changing stages of recovery illustrated in Figure 2. For example, at baseline it was not possible to anticipate the content and/or the acceptability of later questions regarding positive impacts of the earthquakes, such as the opportunity to experience public events and improved quality of housing following repairs. New questions regarding negative impacts reflected the transition from primary stressors, such as aftershocks, to secondary stressors, such as ongoing disruption due to road and construction works as described by Lock et al (2012).

There was detailed discussion at baseline regarding the possible inclusion of a validated wellbeing scale, such as the short-form SF 12 (Ware et al., 1996) in the questionnaire. Ultimately, no scale was included at baseline. This was largely due to concerns regarding

length of scales, and the acceptability of scale questions to respondents. In addition, the 2-item Connor-Davidson resilience scale (Vaishnavi et al., 2007) was considered. As this scale is not in the public domain, however, it was not able to be included, as it could not be reproduced in the survey documentation. From the second time-point onwards, the WHO-5 wellbeing index (Bech et al., 1996) was included in the survey. This five-item emotional wellbeing scale has the advantages of being positively framed, brief, and in the public domain. Limitations of using the WHO-5 in this context are that it has not been validated in the New Zealand context (just one English-language version exists) nor used in other population-based surveys of adults in New Zealand, meaning that no comparison data are available.

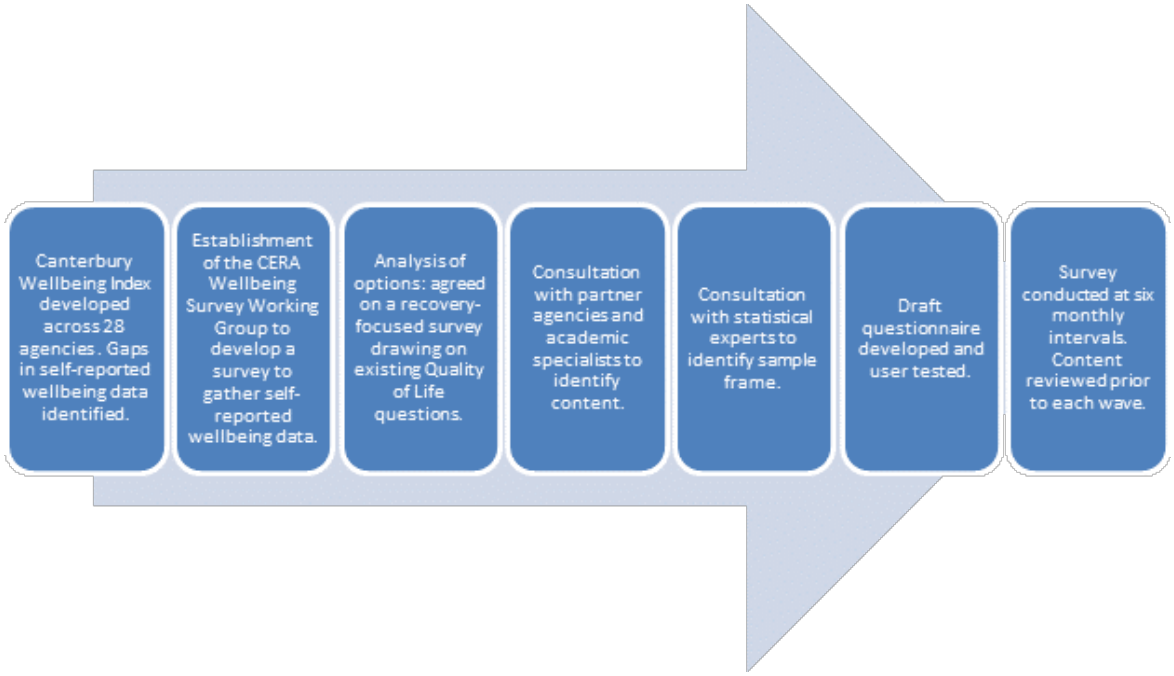


Figure 3. CERA Wellbeing Survey questionnaire development

The questionnaire did not include questions regarding exposure to the earthquakes, symptom checklists, or diagnostic scales (such as a Post Traumatic Stress Disorder scale). This exclusion was on the basis both of a preferred focus on the positive aspects of health and wellbeing, which were largely absent from the routinely available data, and a concern that such scales might cause unnecessary distress in the survey context. In addition, questions regarding risk and protective factors for wellbeing, such as tobacco smoking, alcohol intake and physical activity were not included, as questionnaire space was limited and regional data could be accessed from existing national surveys.

The baseline questionnaire was pre-tested on 13 greater Christchurch residents, selected on the basis of sociodemographic characteristics, with a focus on questionnaire flow, timing and acceptability.

A stratified random sample of adults aged 18 years and above from greater Christchurch was selected from the electoral roll. Preliminary sample size calculations provided by Statistics New Zealand (the government statistics agency) informed planning from early on. The two smaller districts in greater Christchurch were oversampled in order to allow presentation of data by district.

Predictive modelling (based on previous experience of the research company) was used to oversample hard-to-reach groups. Māori were oversampled to boost power for Māori/non-Māori comparisons. De-duplication was carried out at each time-point.

The survey was self-administered and primarily internet-based. Those selected received a personalised letter of invitation with website details and a unique login. There was an option at this stage to call an 0800 number to request a hard copy. A reminder postcard was sent at 10 days, and another at 17 days. At 24 days a hard copy questionnaire (with prepaid envelope) was sent, followed by a final reminder at 38 days (2 weeks later).

2.2 *Limitations*

Limitations of the survey methodology include that use of the electoral roll for sampling does not capture those temporarily or newly in greater Christchurch (a category that is likely to include some migrant workers), excludes non-residents of New Zealand, and is limited by completeness of the roll. However, enrolment is a legal requirement and the roll is the most complete database of individuals in New Zealand.

In addition, the cross sectional design limits ability to draw conclusions regarding time sequence and causality of associations between exposures and outcomes, such as housing situation and mental wellbeing. Also, those leaving greater Christchurch following the earthquakes are not included in the survey, although this has the advantage of maintaining the focus on the current population at each time-point. A prospective cohort study design was discussed but considered too resource-intensive and not to have this advantage.

Psychometric analyses such as confirmatory factor analysis were not possible during the short time available for questionnaire development. A validated wellbeing scale was used from the second time-point, and the timing, face validity and acceptability of the survey questions were considered at length and assessed positively at the pre-test stage.

Finally, it is useful to note the extent to which the urgency of the recovery context has necessitated the role of CERA as lead agency in the development of the CERA Wellbeing Survey, and associated Canterbury Wellbeing Index. This has involved significant advantages, particularly the political will, legislated mandate and resource commitment to undertake this work. It has also helped ensure that the research findings will inform decision-making by CERA and recovery partners, and facilitated ongoing active and positive engagement between researchers representing key partner agencies. The CERA-led multi-agency approach has also placed some constraints on the project. The importance of making the full survey questionnaire available, for instance, in the interests of transparency, made it impossible to include the Connor-Davidson resilience scale, which is not in the public domain.

The CERA survey was jointly funded by the NHRP and CERA, and administered by Nielsen, a private research provider.

3. Results

The response rate for the survey was 52% (n=2,381), 48% (n=2,438), and 43% (n=2,476) in September 2012, April 2013 and September 2013, respectively. The observed decline in response rate over time is thought to be due to the increasing time elapsed since the

earthquakes and in part to increased oversampling of groups that were less likely to respond, specifically males and young people.

The sample size by area and margins for error are presented in table 1. Survey data were weighted by gender, age, region (district) and ethnicity to reflect the known population proportions. This methodology results in the sample at each time-point mirroring the population characteristics (as captured by the New Zealand Census). At baseline, the gender distribution was 49% male to 51% female (43%:57% unweighted). The age distribution was (unweighted percentage in parentheses) 18-24 years 14% (10%), 25-34 years 11% (8%), 35-49 years 32% (26%), 50-64 years 24% (29%) and 65+ years 18% (26%). The New Zealand Māori ethnic group (4%) and New Zealand European ethnic group (90%) were under- and over-represented, respectively, at baseline and weighted accordingly to 6% and 87%.

Table 1. Sample size and error margin by Territorial Local Authority

TLA	September 2012 Sample Size (and maximum margin of error)	April 2013 Sample Size (and maximum margin of error)	September 2013 Sample Size (and maximum margin of error)
Christchurch City	1156 (± 2.9)	1210 (± 2.8)	1240 (± 2.8)
Selwyn District	618 (± 3.9)	621 (± 3.9)	640 (± 3.9)
Waimakariri District	607 (± 4.0)	607 (± 4.0)	596 (± 4.0)

Respondents were asked to rate their overall quality of life and, over the three time-points to date, results have been relatively stable, with around three quarters of the population rating their quality of life as good or extremely good (Figure 4). In the first CWS (2012) eighteen months after the February 2011 earthquake 74% of the population rated their quality of life positively (good or extremely good) compared with an average of 80% across the six main cities of New Zealand.

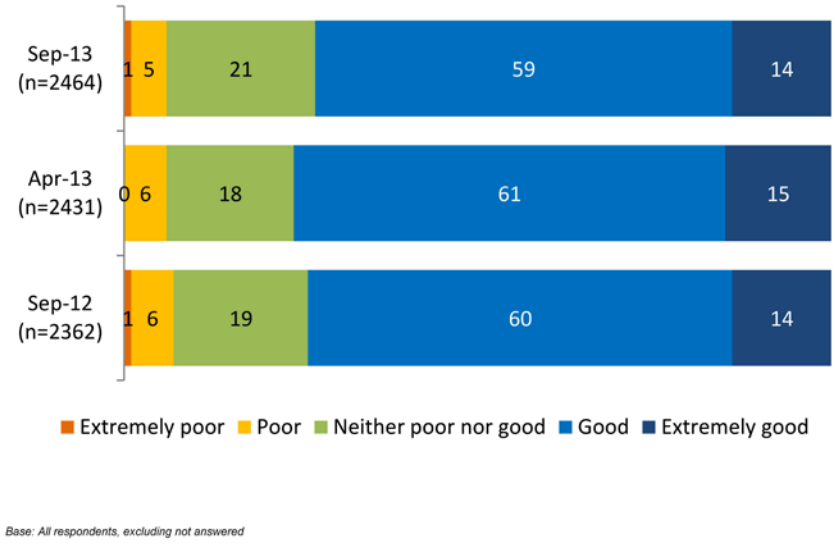


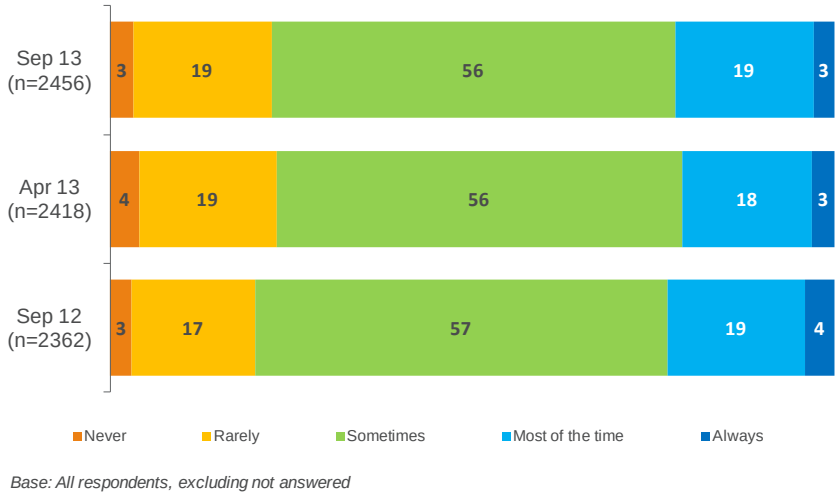
Figure 4: Overall quality of life, over time (%)

Populations consistently rating their quality of life more positively were those aged 18-24 years and those earning higher incomes (a household income of >$100,000 NZD).

Populations less likely to rate their overall quality of life positively varied more but tended to be those with pre-existing vulnerabilities including those on low household incomes (<$30,000 NZD), renters, people with ill health or a disability, Maori, Pacific and other numerically non-dominant/ethnic minority groups, and older people. A newly vulnerable population also emerged with those living in temporary accommodation as a result of earthquake generated household displacement.

Respondents were asked whether they had experienced stress within the past year that had a negative impact on them. While the majority of residents have experienced stress at least sometimes, the proportion experiencing stress always or most of the time remains between 20-23%

In the first CWS (2012) in September 2012, 20% of the population had experienced stress always or most of the time compared with an average of 18% across the six main cities of New Zealand.



Base: All respondents, excluding not answered

Figure 5: Experience of stress that has had a negative effect in the past 12 months, over time

The WHO-5 scale of emotional wellbeing was included in the April and September 2013 surveys and the median scores remaned stable at 13.8 and 13.7 respectively in each survey. While the lack of baseline data limits interpretation of this scale, a sub-population analysis identifies which population groups may be experiencing a slower recovery and require targeted services.

Two distinct populations were identified that were more likely to have a raw WHO-5 score below the mean. Those with identified pre-existing vulnerabilities, including Maori respondents, those receiving low incomes, and those with a physical health condition or disability make up the first of these groups. In addition, however, survey responses indicated a second, 'newly' vulnerable population of 35-49 year olds who were also more likely to have a score below the mean. Those more likely to have a score above the mean were higher income households and younger people aged 18-24 years.

A list of up to 27 issues was included in each survey to identify which stressors were having a moderate or major negative impact on the everyday lives of respondents. These issues were a mixture of primary stressors caused directly by the event (for example distress relating to aftershocks) and secondary stressors indirectly caused by the event (for example additional work pressures or dealing with insurance and house damage).

As table 2 below demonstrates, the greatest stressor identified in the September 2012 survey was 'distress and anxiety relating to the aftershocks' which had a moderate or major negative impact on 42% of respondents. One year later only 14% of respondents indicated that this was a stressor, a decrease that is likely to be related to a drop in seismic activity over the previous year.

In the two subsequent waves of surveying the secondary stressors of 'dealing with EQC/insurance', 'making decisions about house repairs and damage' and 'being in a damaged environment and/or surrounded by construction work' have had the greatest negative impacts on respondents.

Of all 27 issues, dealing with EQC/insurance continues to be the most prevalent and just under a quarter of respondents (23%) reported in September 2013 that this issue is still

having a moderate or major negative impact on their everyday lives. Those most affected by this stressor were homeowners aged 35 to 49 years. When asked what about this stressor affects them most, this group primarily reported frustrations with the length of the process. 'Making decisions about house damage, repairs and relocation' was an aligned stressor and was particularly affecting those who were displaced from their homes and living in temporary accommodation.

'Living in a damaged environment and or being surrounded by construction work' continued to negatively affect one fifth of the population in September 2013.

Table 2: Proportion of respondents that indicated an issue continued to have a moderate or major negative impact on their everyday lives, over time (%)

(Issues ranked based on September 2013 results – from highest to lowest in term of proportion still being strongly impacted by each issue)	September 2012	April 2013	September 2013
Dealing with EQC/insurance issues in relation to personal property and house	37	26✓	23✓
Making decisions about house damage, repairs and relocation	29	22✓	21
Being in a damaged environment and / or surrounded by construction work	30	21✓	20
Loss of other recreational, cultural and leisure time facilities	34	21✓	17
Living day to day in a damaged home	22	16✓	16
Uncertainty about my own or my family's future in Canterbury	30	16✓	16
Additional financial burdens	26	16✓	15
Transport related pressures	20	17✓	14✓
Distress or anxiety associated with ongoing aftershocks	42	16✓	14
Poor quality of house	14	10✓	13✗
Loss of indoor sports and active recreation facilities	24	16✓	13
Additional work pressures	27	16✓	12✓
Having to move house permanently or temporarily	16	13✓	12
Loss of usual access to the natural environment	24	13✓	10
Loss of outdoor sports and active recreation facilities	20	12✓	10
Difficulty finding suitable rental accommodation	12	9✓	10
Relationship problems	16	9✓	9
Loss of meeting places for community events	NA*	10	8
Potential or actual loss of employment or income	18	10✓	7✓
Lack of opportunities to engage with others in my community through arts, cultural, sports or other leisure pursuits	15	9✓	7
Dealing with insurance issues in relation to a business or work	11	9✓	7
Loss or relocation of services	13	8✓	7

Dealing with barriers around disabilities whether existing or earthquake related	12	8✓	6
Workplace safety concerns	16	6✓	6
Dealing with frightened, upset or unsettled children	18	7✓	5
Difficult decisions concerning pets	10	6✓	5
House too small for the number of people in the household	3	3	4

An investigation into the interdependencies of every pairwise comparison of quality of life, community, negative impact extent, and positive impact extent variables measured at baseline (some n=780 combinations) was undertaken using Spearman's correlation. Ignoring the sign, the median estimated weighted correlation was 0.194 (Q1=0.096, Q3=0.305) – with smallest of 0.000 and largest of 0.796. The overwhelming majority of pair-wise comparisons had negligible or weak relationships; only a minority had strong relationships, and 4 (0.5%) had an estimated weighted correlation above 0.7.

4. Discussion

4.1 *Survey results:*

To date, the ongoing CERA Wellbeing Survey has provided a unique and valuable indication of community wellbeing over time, as the recovery progresses, and seismic activity diminishes.

The inclusion of Quality Of Life survey questions enables useful comparisons to areas not directly affected by the earthquakes, to Christchurch (city) pre-quakes, and to national data. These comparisons are important for interpreting results in light of the wider context, such as the macroeconomic situation (Chang 2010). The observed drop in overall self-rated quality of life, for example, appears to be part of a wider, national trend, indicated in lower self-rated quality of life reporting across the country in the Quality of Life survey, although to a lesser extent. This indicates that caution needs to be used when interpreting trends in relation to the earthquake sequence. Advantages of the survey methodology include that it was cost effective, with a satisfactory response rate (Cook et al., 2000). However, the response rate has been dropping with each survey wave which, may reflect a declining focus on recovery issues for the population. Similarly, with each survey wave there is a growth in the proportion of respondents who provide 'neutral' responses and a reduction in the numbers affected by many of the stressors. These may be reflecting the progress of the population through the recovery process.

While the observed positive association between increasing income and self-reported quality of life and wellbeing is well established, the WHO-5 scale scores and overall quality of life question responses highlight the negative impact of stressors specific to the recovery environment. Displacement due to the earthquakes is associated with poorer quality of life. The identification of a newly vulnerable group, the 39-45 year olds, appears to reflect cumulative impacts related to the life stage of this group. This theory is supported by the finding that these respondents were also more likely to report negative impacts associated with home ownership, distressed children, and workplace issues, for example.

Dealing with EQC and private insurers continues to have a comparatively high negative impact, in part highlighting complexities specific to the New Zealand disaster insurance situation. The persistence of being in a damaged environment and the loss of recreational, cultural and leisure facilities as negative impacts reflects the magnitude and complexity of the rebuild process.

4.2 *Operational and research aims:*

The CERA Wellbeing Survey has also been successful in gathering useful operational data. CERA and other recovery partners have used survey data to inform a range of decision-making. In addition to facilitating efforts to monitor the overall progress of the recovery, these data have also helped contribute to the identification of stressors that are impacting most at each survey wave, making it possible to target population groups that are identified through survey data as requiring additional supports.

In particular these data have informed the cross-agency programme of psychosocial services, supports and information that has been put in place to support people's wellbeing. Data identifying that recovery has been slower amongst those with pre-existing vulnerabilities (people with a physical health condition or disability, low income and Māori) and those 'new vulnerable' populations (people in temporary accommodation and those aged 35-49 years old) has informed the targeting of psychosocial services, supports and information towards those population groups.

Survey data have been utilized to inform the allocation of resources. Data from the CERA Wellbeing Survey showing that there are significant ongoing psychosocial needs were recently considered by the Government in its decision to allocate a further four years of funding for free counseling, a telephone help and advice line and a coordination service that supports households as they navigate social services and the rebuild process. In addition, the survey findings have contributed to the development of a public health mental wellbeing social marketing campaign, the 'All right?' campaign, by the CDHB and the New Zealand Mental Health Foundation.

CWS reports are published in full after each survey wave on the CERA website, and so provide a valuable resource for researchers. The CWS data-set promises to be equally valuable as further time-points are added. The collaborative process has helped establish the basis for a researcher network of researchers across organizations and agencies. It is also hoped that the success of this collaborative cross-sector, multi-agency approach will constitute a valuable model for others, by adding to the body of disaster recovery monitoring literature.

Reference List

Adams, R. E., & Boscarino, J. A. (2005). Differences in mental health outcomes among Whites, African Americans, and Hispanics following a disaster. *Psychiatry*, *68*(3), 250–265.

Bech, P., Gudex, C., & Staehr Johansen, K. (1996). The WHO (Ten) Well-Being Index: Validation in Diabetes. *Psychother Psychosom*, *65*, 183–190.

Bidwell, S. (2011). *Designing indicators for measuring recovery from disasters*. Christchurch, New Zealand.

Cash, D. W., Clark, W. C., Alcock, F., Dickson, N. M., Eckley, N., Guston, D. H., … Mitchell, R. B. (2003). Knowledge sytems for sustainable development. *PNAS - Proceedings of the National Academy of Sciences*, *100*(14), 8086–8091.

Chang, S. E. (2010). Urban disaster recovery: a measurement framework and its application to the 1995 Kobe earthquake. *Disasters*, *34*(2), 303–27. doi:10.1111/j.1467-7717.2009.01130.x

Chang, S. E., Taylor, J. E., Elwood, K. J., Seville, E., Brunsdon, D., & Gartner, M. (2014). Urban Disaster Recovery in Christchurch: The Central Business District Cordon and Other Critical Decisions. *Earthquake Spectra*, *30*(1), 513–532. doi:10.1193/022413EQS050M

Chou, F. H., Chou, P., Lin, C., Su, T. T., Ou-Yang, W. C., Chien, I. C., … Chen, M. C. (2004). The relationship between quality of life and psychiatric impairment for a Taiwanese community post-earthquake. , . *Quality of Life Research*, *13*(6), 1809–1097.

Earthquake Commission Act (1993). New Zealand Government.

Johnson, L. a., & Mamula-Seadon, L. (2014). Transforming Governance: How National Policies and Organizations for Managing Disaster Recovery Evolved Following the 4 September 2010 and 22 February 2011 Canterbury Earthquakes. *Earthquake Spectra*, *30*(1), 577–605. doi:10.1193/032513EQS078M

King, A., Middleton, D., Brown, C., Johnston, D., & Johal, S. (2014). Insurance: Its Role in Recovery from the 2010–2011 Canterbury Earthquake Sequence. *Earthquake Spectra*, *30*(1), 475–491. doi:10.1193/022813EQS058M

Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. R., & Pfefferbaum, R. L. (2008). Community Resilience as a Metaphor, Theory, Set of Capacities, and Strategy for Disaster Readiness. *American Journal of Community Psychology*, *41*, 127–150.

Quarantelli, R. L. (1999). *The disaster recovery process: what we know and do not know from research. Preliminary paper No. 286.* Newark, Delaware. Retrieved from http://dspace.udel.edu:8080/dspace/bitstream/handle/19716/309/PP286.pdf?sequence=1

Rogers, N., Williams, K., Jacka, M., Wallace, S., & Leeves, J. (2014). Geotechnical Aspects of Disaster Recovery Planning in Residential Christchurch and Surrounding Districts Affected by Liquefaction. *Earthquake Spectra*, *30*(1), 493–512. doi:10.1193/021513EQS029M

Sabucedo, J. M. (2010). Symptomatic profile and health-related quality of life of persons affected by the Prestige catastrophe. *Disasters*, *34*(3), 809–820.

Shelton, S., Connor, K., Uscher-Pines, L., Pillemer, F. M., Mullikin, J. M., & Kellerman, A. L. (2012). Bioterrorism And Biological Threats Dominate Federal Health Security Research; Other Priorities Get Scant Attention Shoshana R. Shelton1,*, Kathryn

Connor2, Lori Uscher-Pines3, Francesca Matthews Pillemer4, James M. Mullikin5 and Arthur L. Kellermann6. *Health Affairs*, *31*(12), 2755–2763.

Skogstad, G. (2005). Policy Networks and Policy Communities: Conceptual Evolution and Governing Realities. In *Annual Meeting of the Canadian Political Science Association* (pp. 1–19). London, Ontario.

Stevenson, J. R., Chang-Richards, Y., Conradson, D., Wilkinson, S., Vargo, J., Seville, E., & Brunsdon, D. (2014). Organizational Networks and Recovery Following the Canterbury Earthquakes. *Earthquake Spectra*, *30*(1), 555–575. doi:10.1193/022013EQS041MR

Tapsell, S. M., & Tunstall, S. M. (2008). "I wish I'd never heard of Banbury". The relationship between "place" and the health impacts from flooding. *Health and Place*, *14*(2), 133–154.

Toyabe, S., Shioiri, T., Kobayashi, K., Kuwabara, H., Koizumi, M., Endo, T., … et al. (2007). Toyabe, S., Shioiri, T., Kobayashi, K., Kuwabara, H., Koizumi, M., Endo, T., Ito, M. et al. Factor structure of the General Health Questionnaire (GHQ-12) in subjects who had suffered from the 2004 Niigata-Chuetsu earthquake in Japan: a community-based stu. *BMC Public Health*, *7*, 175.

Vaishnavi, S., Connor, K., & Davidson, J. (2007). An abbreviated version of the Connor-Davidson Resilience Scale (CD-RISC): Psychometric properties and applications in psychopharmacological trials. *Psychiatry Research*, *152*(2-3), 293–297.

Van Ballegooy, S., Malan, P., Lacrosse, V., Jacka, M. E., Cubrinovski, M., Bray, J. D., … Cowan, H. (2014). Assessment of Liquefaction-Induced Land Damage for Residential Christchurch. *Earthquake Spectra*, *30*(1), 31–55. doi:10.1193/031813EQS070M

Verger, P., Rotily, M., Hunault, C., Brenot, J., Baruffol, E., & Bard, D. (2003). Assessment of exposure to a flood disaster in a mental-health study. *Journal of Exposure Analysis and Environmental Epidemiology*, *13*(6), 436–442.

Ware, J. E., Kosinski, M., & Keller, S. D. (1996). SF-12: An even shorter health survey. 1996 4(1):2. *Medical Outcomes Trust Bulletin*, *4*(1), 2.

To add:

Britt, E., Carter, J., Conradson, D., Scott, A., Vargo, J. & Moss, H. (2012). Resilience framework and guidelines for practice. Report for the Ministry of Social Development. Christchurch, New Zealand: University of Canterbury.

Carr, V., Lewin, T., Kenardy, J., Webster, R., Hazell, P., Carter, G., and Williamson, M. (1997) Psychosocial sequelae of the 1989 Newcastle earthquake: III. Role of vulnerability factors in post-disaster methodology. *Psychological Medicine*, 27, 179-190.

CERA. (2012). Recovery Strategy for Greater Christchurch: Mahere Haumanutanga o Waitaha. Christchurch, New Zealand: Canterbury Earthquake Recovery Authority.

Lock, S., Rubin, J., Murray, V., Rogers, B., Amlôt, R., and Williams, R. (2012) Secondary stressors and extreme events and disasters: A systematic review of primary research

from 2010-2011.PLOS Currents Disasters. Edition 1. Doi:10.1371/currents.dis.a9b76fed1b2dd5c5bfcfc13c87a2f24f.

New Economics Foundation 2014 National accounts of well-being. What is well-being? accessed 20.11.2014 from nationalaccountsofwellbeing.org.what-is-well-being.html.

WHO 1948 Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946.