MEDIANZ • VOL 14 NO 1 • 2014
DOI: http://dx.doi.org/10.11157/medianz-vol14iss1id107

- ARTICLE -

# www.useless.com
# Crisis Communications on Shaky Ground

*Kris Vavasour*

## Abstract

After the magnitude 6.3 earthquake that struck the city of Christchurch on February 22, 2011, the physical and communications infrastructure that many city dwellers rely on suddenly ceased to function. For many, this disruption to physical and virtual networks resulted in access to media, information, assistance and family being cut off or restricted in a number of different ways. Survey results show residents of the less-damaged suburbs made more use of television, websites and social media than those in badly damaged areas, who relied more on radio, word-of-mouth, and print material.

Social media and new technologies are now an established part of the crisis communications discourse; however, the infrastructure they rely on is not as solid and reliable as it may appear. After exploring the concept of blackboxing, the failures and weaknesses of previously backgrounded objects exposed by the earthquakes provide examples of its undoing (un-blackboxing). Quantitative and qualitative survey data is used to show how variations in location and disruption impacted on the information-seeking of residents, and how the un-blackboxing of infrastructure and socio-technical networks left residents out of the loop. This research also challenges perceptions of how widely used, accessible and/or useful technologies like Twitter are to those in the middle of a disaster.

## Introduction

At 12:51pm on 22 February 2011, the city of Christchurch, New Zealand, was rocked by an earthquake of magnitude 6.3. Although technically an aftershock of the magnitude 7.1 earthquake that struck the region on 4 September 2010, the earthquake of 22 February was the most violently disruptive of the whole earthquake sequence. It is this particular earthquake, with its intense ground acceleration, nearby epicentre, and devastating effects, that has become known as 'the Christchurch earthquake'. However despite the attention to this one particular place and time, it was not a one-off event, and not all parts of the city were equally affected. This article investigates the impact

---

Kris Vavasour is an MA student at the University of Canterbury. She lost her family home to the earthquakes of 4 September 2010, and now lives in a new home on her old (TC2) section in suburban Christchurch. She is grateful to all those who participated in this research, and for the guidance of Dr Paul C. Adams, Dr Julie Cupples, and Dr Ruth Zanker.

that location has on the use and availability of media and technology during disaster by looking at the information-seeking methods of residents in different parts of the city.

The infrastructure involved with media and communications is prone to disruption during a crisis, and this can have a severe impact on the availability of information. Research into the use of social media during disasters details the development and testing of many interesting applications, but there are some who caution against this increasing focus and reliance on technology and the intricate systems that support it. Urban infrastructure has a tendency to become 'blackboxed', a process by which complex, interconnected components and networks come to be perceived as deceptively simple objects, and during a disaster these networks and objects can become spectacularly undone, in a process known as 'un-blackboxing'. By exploring the impact of failure and un-blackboxing on the use and usefulness of various media and communication methods, this research also seeks to understand how the Internet and social media perform within the overall media ecology during disaster.

## Background

### Media and disaster

In the aftermath of a crisis or disaster, the media in its many forms serves as a crucial conduit between those with information and those who seek it. The role of the media varies not only according to the phase of the crisis (Garnett and Kouzmin 2007, 175), but it also depends on the location – of both the disaster and the audience. In countries like Indonesia, Japan, and Nepal, community radio has 'played a big role in disaster management [by delivering] information that is suited to the needs of the community and packaged in their own language' (Chhetri and Narayan 2010, par. 6). In Haiti, the one radio station that was able to continue broadcasting after the 2010 earthquake became a 'lifeline for the Haitian public' (Nelson and Sigal 2011, 11). In 2001, Americans reported using many different types of media at home or at work, often simultaneously, as they tried to keep up with the news of the 9/11 terrorist attacks, and TV news channels and news programming continued to rate highly for weeks (Carey 2002, 202-203).

While broadcast and print media have previously been the main source of detailed information about disasters (Piotrowski and Armstrong 1998), this function is increasingly served by the Internet (Carey 2002), and often by individuals rather than organisations. After the 2004 Boxing Day tsunami, and in the aftermath of Hurricane Katrina in 2005, residents were sharing news on personal weblogs (blogs), helping with rescue efforts, recording damage, and critiquing government response (Macias, Hilyard and Freimuth 2009). Blogs are often used as sources for news items, partly because they can 'disseminate information much faster than large organizations' (Jefferson 2006, 140), but blogs are just one of many online spaces for sharing news and information about disasters. During the Virginia Tech shootings in 2007, concerned friends and

family members used social media sites to check on students' wellbeing, and also posted updates to the Virginia Tech Wikipedia page (Palen et al 2009, 471-2).

Social media technologies have become an established part of the crisis communications discourse, and in recent years much attention has focused on an online platform that is limited to just 140 characters per message. Twitter, the popular social media site and micro-blogging service that launched in 2006, now has more than 241 million active users every month with an average of 500 million messages (tweets) being sent every day (MacArthur n.d.; Smith 2014). Tweets that are sent to, from, or about disaster zones have added to the public discussion of disaster as well as providing data for rescuers and researchers. Researchers in Japan have suggested that by monitoring key words used in tweets, Twitter could potentially be used as a real-time event sensor for earthquake activity (Sakaki, Okazaki and Matsuo 2010). There are also many software platforms and applications that utilise crowd-sourced data – like the information contained in tweets – that have been developed and tested in disaster zones.

The Ushahidi platform is an online crisis-mapping program that was originally developed to chart election violence in Kenya in 2007, and was then adapted to aggregate and share emergency data in Haiti after the 2010 earthquake (Nelson and Sigal 2011, 13). Since then, Ushahidi and crowd-sourced data have informed rescue efforts after the earthquakes in Christchurch, New Zealand; after the earthquake and tsunami in Tohuku, Japan; and after Hurricane Sandy in New York (Hansen 2011; Yeomans 2012). Another application making use of crowd-sourced data is Google's Person Finder service. First used in Haiti, Person Finder has also been used to reunite survivors and loved ones after the earthquakes in New Zealand and Japan, after the Boston Marathon bombings, and in the aftermath of Typhoon Haiyan in the Philippines (Gaudin 2013; McCue 2013; Schiller 2011; Walls 2011).

Those interested in the use of social media after the Christchurch earthquakes of 2010-2011 have no shortage of material to choose from. Austrin and Farnsworth describe how 'a flood of material [appeared] on social media, from Twitter to Facebook, and in every other conceivable mediated outlet… each piecing together a shifting portrait of the city like an incomplete tapestry' (2012, 83-4). Volunteer clean-up efforts were co-ordinated through Facebook, earthquake-related discussion forums were created on TradeMe (an online auction site), and *The New Zealand Herald* newspaper used Storify and Twitter hashtags to create news content for their website (MacManus 2011). In a 3News website update written on 22 February, Murray describes how the New Zealand Twitter trends map was taken over by earthquake-related tweets. He also notes that most of these tweets 'emanated from the more populous North Island, as Cantabrians would have struggled to access the internet from mobile phones' (2011, par. 4). Technology may have enabled instant worldwide discussion about a crisis, but those closest to the event may find themselves unable to participate in these electronic conversations.

For those monitoring Twitter content, the sheer quantity of tweets sent after the February earthquake made finding accurate and up-to-date information a struggle at times. Researchers Bruns and Burgess identified more than 20,000 unique users involved with the #eqnz hashtag on February 22, 2011, and at times, more than 1000 tweets per hour were being sent (2012, 11-12). Writing for *The National Business Review* on 23 February, Walls reports that Twitter had become overloaded several times, and that the #eqnz feed had been throttled, or restricted (2011, par. 1). However, it was not only the quantity of the tweets that was causing problems. As Walls observes, 'not all social media that glistens is gold . . . . Misinformation has flown at the speed of light as desperate users find random re-tweets or pick up on the unfiltered speculations of those following coverage' (par. 4). Tweets using the #eqnz hashtag ranged from people discovering their destroyed homes or finding loved ones, to businesses promoting sales, websites and scams (Metal 2011, par. 18).

Despite the questionable 'signal-to-noise' ratio of this unmoderated information stream, Bruns and Burgess describe Twitter, and social media in general, as 'key elements in the overall ecology of the media forms used for crisis communication' (2012, 2). They consider Twitter to be an important tool for affected communities to communicate among themselves, and with emergency management. Research into the use of social media by the Christchurch City Council (CCC) during this time, shows that, as well as using Facebook, Twitter, and a WordPress site to push information out to the public, the CCC also utilised media monitors who tracked social media content to assess residents' needs. Requests deemed urgent 'were immediately forwarded to incident commanders for a quick evaluation and response' (Sutton 2012, 3). While this is a commendable action plan, the communication technologies that many urbanites rely on are prone to failure during a disaster, just when they are needed most.

## Blackboxing

Information can be crucial to surviving a disaster. However, that information is most valuable when it is both accessible and relevant. Pipes and Knudson note that 'inaccessible information is, of course, useless and, unfortunately, electronic information is quite vulnerable to destruction that renders it inaccessible' (2006, 423). Although crises provide many opportunities for new products to be showcased, Garnett and Kouzmin suggest there is an 'overreliance on technology when other communications media [are] useful complements – and probably more appropriate' (2007, 178). They argue that by focusing on the appeal or potential applications of technology, equally important aspects may be ignored – like reliability and accessibility, and the ingenuity sometimes required to work around infrastructure and network failures (182).

It has been said that city dwellers have become 'hostages to electricity', reliant on vast urban infrastructure that is not as stable or invisible as is often assumed (Graham 2012, 18). These networks may appear to be static and permanent but, during a crisis, can reveal themselves to be a work-in-progress that 'requires constant effort to maintain'

(16). According to Graham, infrastructure has become the 'Achilles heel' of urbanized societies, as the background systems and objects that support modern urban life have become hidden or naturalized. This process is known as 'blackboxing', in which a seemingly simple exterior masks a complex network of interactions (Graham 2012; Latour 2005; Law 1992). Everyday items and systems, like communications networks and city infrastructure, are given little attention until such time as they are completely disrupted and made visible once more, revealing their complex networks and precarious nature in a process known as 'un-blackboxing' (Graham 2012, 18).

These concepts are not restricted to physical structures or tangible objects. For many city residents, a significant proportion of daily social interaction takes place in an electronic environment that is just as prone to these processes of blackboxing and un-blackboxing as any individual piece of technology. As Austrin and Farnsworth note, when these 'sociotechnical networks' of urban society are violently disrupted by disaster, any breaks in the 'chains of sociotechnical connection [can leave] citizens vulnerable and disconnected' (2012, 80). For those living in a disaster zone, the breaking down (un-blackboxing) of infrastructure, technology, and virtual social connections is often all too evident.

Many of Graham's depictions of un-blackboxing describe the chaos that can be caused by a loss of electricity. However during a large-scale disaster, electricity loss is more likely to be a symptom rather than the cause of the disruption. In the aftermath of a large earthquake, even when the power supply is restored, the sewer pipes, roads, and communication networks could still be non-functional. While the process of un-blackboxing may be the same whether electricity loss is caused by a small equipment fault or a major natural disaster, the scope and duration of disruption to city and society is much greater from the latter. It is not only communications networks and infrastructure that can become blackboxed; when viewed from a distance, disasters may also be perceived as a single event or location that masks many complexities and differences.

## Perspective

Recognising that the scale, scope, and duration of social disruption are important indicators as to the severity of an event, Fischer has suggested grading emergencies, disasters, and catastrophes on a scale from one to ten (2003, 100). However, even though researchers have repeatedly tried to impose 'neat, clean patterns' onto disasters, the interaction between disaster and society is usually anything but neat and clean (Neal 1997, 256). After the earthquake of 22 February 2011, damage in Christchurch and surrounding areas ranged from the barely noticeable to complete devastation, sometimes within a very short distance. Broadly speaking, the damage was significantly worse in the eastern suburbs of the city – a situation that led to Christchurch being described as a 'city of two halves' (Consedine 2012; McCrone 2013; McIvor 2011). While there was some validity in describing the earthquake damage in terms of an

East/West split, the damage and disruption often crossed those neat geographic boundaries in messy and uneven ways.

For those experiencing a disaster first-hand, failing communication technologies is just one aspect of what can be an extremely chaotic and unpredictable situation. Loss of power may be easily measurable but it is only part of the equation; those with the most damage and/or experiencing the greatest disruption often have the greatest need for, and the least access to, information and assistance. One eastern suburbs resident posted a plea for help to his blog on March 2, just eight days after the February 22 earthquake. His description of the 'three cities of Christchurch' not only highlighted the variations in living conditions but also struck a chord with local residents and media (see Anderson 2011; Edwards 2011; Hayden 2011; Lew 2011; 'Refugee City' 2011). Ignoring the simplistic East/West divisions and focusing instead on the distress and disruption being experienced, Hyde sought to drag the media's focus from the dramatic and telegenic damage in the central city to the desperate plight of many suburban residents.

In a scathing critique of both the media coverage and the official response to the earthquake, Hyde divided the city into three. The central business district was renamed 'Rescue City': few people lived there but it provided extremely television-friendly tales of 'tragedy, loss, broken iconic buildings, heroism, sacrifice, leadership and gratifying international response' (Hyde 2011, par. 7). 'Shower City' comprised of the (mostly western) parts of the city that had electricity and working sewers, where people could take a hot shower, and where the media and key decision-makers were also based (par. 11). Finally there was 'Refugee City', which was dominated by the eastern suburbs but also had pockets in other areas, in which almost no-one had running water and only half had power (par. 13). Hyde described the new reality of daily life for residents of Refugee City:

> There are no showers… No working toilets, and precious few portaloos… They have no internet either, and usually no phones. And their radio batteries are dead or dying. The papers – if you can get one – are rapidly dated, and usually far too general in their coverage. … It's remarkably hard to call talkback radio – or your local politician – or emergency services – when your landline is out and your cellphone battery is dead. Or when it maybe has JUST enough charge to stay on hold for 5 minutes – but not 20! – when calling the sole government helpline. (par. 15-17)

This is the disrupted sociotechnical environment in which a large number of Christchurch residents found themselves in the immediate aftermath of the 22 February earthquake. Many were without electricity, safe drinking water, or functioning sewers, and some were in temporary shelter, but all of them wanted detailed and specific information about the chaotic situation they suddenly found themselves in. With no power, no functional phones, and no access to the Internet, many of the city's usually well-connected residents felt completely cut off.

Although location may no longer be a barrier when communicating *about* disaster, it can make a big difference to communication *during* disaster. While not disputing that there is value in the use of social media and new technologies during and after disaster, this research aims to provide some context by placing them back within the wider media ecology of a damaged and disrupted city. There are many examples of online information-sharing and collaboration in the aftermath of the Christchurch earthquakes, but rather than concentrating on how the technology works, this research focuses on what happens when technology doesn't work as expected. By looking at the reliability and resilience of different media and communication technologies, the processes of blackboxing and un-blackboxing can be explored. Ultimately, this research seeks to highlight the messy complexity of media use and information-seeking during disaster by documenting and analysing the experiences of Christchurch residents.

## Methodology

### Survey development and participant recruitment

This survey on media use and communication methods was initially developed by Dr Paul Adams, of the University of Texas, Austin, who visited the University of Canterbury as an Erskine fellow in 2011. The survey project was given to this researcher, who saw the project through to completion, after making a few changes to the questionnaire. The original wording of questions enquiring about media use 'during or after the earthquake' were altered, for the following reasons: firstly, 'during' may be a very short time period; secondly, the upheaval may be so violent that operating equipment of any kind is not feasible; and finally, because it wasn't just a single earthquake – there were thousands. Questions were rephrased and then grouped according to the following timeframes: on the day of the February earthquake; in the days and weeks following the February earthquake; or the overall period from the first earthquake in September 2010 through to the time of the survey in September-October 2011.

Although the devastating magnitude 6.3 earthquake of 22 February 2011 occurred seven months before this survey was undertaken, the sheer number of aftershocks that continued to rock the city meant 'the earthquake' was still very much a current event. Figures from the Christchurch Quake Map website show that between 22 February and 3 October 2011 (when the survey closed), there were more than 5500 earthquakes in Canterbury, including a violent cluster of aftershocks on 13 June 2011. Although February's deadly earthquake is the one most people refer to as 'the Christchurch earthquake', this was just one of more than 13,000 earthquakes to occur in Canterbury since this seismic sequence began on 4 September 2010.

The survey methodology was also changed, from a paper-based survey to an online one, as this does not require direct contact and can be done at a time and place that suits respondents. The use of an existing online survey platform (Qualtrics.com) enabled the survey to be set up quickly and simply, and the hyperlink was easily shared via email, websites, and social media. In an attempt to counter the selection bias inherent in a

convenience sampling method that relies on electronic distribution and personal connections, a number of different geographic, cultural and interest groups were identified and contacted. The survey link was emailed to neighbourhood and community groups, shared on Facebook, posted to local discussion forums and earthquake-related websites, and was tweeted using the #eqnz hashtag. In addition, every piece of communication encouraged the snowball method of recruitment, in which readers/recipients are asked to share the survey link with others who might be interested in taking part.

It is inevitable that some sectors of the community will be under-represented in this type of research – particularly people without access to the Internet, and those with limited English language skills. However, statistics show 80 per cent of New Zealand households do have some kind of Internet connection (Statistics NZ 'Household Use' n.d., par. 1), and those who do not regularly interact with the online world are less likely to notice its absence in a time of crisis. Investigating the issues that speakers of other languages face during a crisis in an English-speaking country would benefit from a different approach, like interviews or questionnaires in their own language. Although these groups were not the focus of this survey, it is worth noting their absence from the data. There have been studies on the effects that various differences have had on communication and media use during disaster; however, they tend to focus on pre-existing differences, like language (Enander and Wallenius 1999; Falkheimer and Heide 2006; Olofsson 2007), gender and social class (Fordham 1999; Chhetri and Narayan 2010), and race (Spence, Lachlan and Griffin 2007), rather than on differences created by the effects of the disaster itself.

During the response collection timeframe (September 6 to October 3, 2011), 447 surveys were started, with 349 respondents answering all questions in section one – a completion rate of 78 per cent. The overall response rate of the survey is unknown as it cannot be determined how many people saw the survey link or invitation. Respondents who completed the main survey questions (section one) were given the choice of either exiting the survey at that point, or continuing to a further eight open-entry questions about communication issues. Almost 60 per cent of respondents went on to answer one or more questions in section two.

## Respondents

The skewed nature of the respondents' demographic details is the clearest indication that this sample is not statistically representative of the wider city population. Although the main recruitment aim of ensuring a good geographic spread was met, the age and gender of respondents is less well-balanced. The majority of survey respondents are female (73%), which differs markedly from the more even distribution of males and females among the city population, as can be seen in the following table. Statistics for the wider Christchurch population have been taken from the 2006 census, the last to be conducted before the earthquakes (Statistics NZ 'Tables' n.d.).

| Gender | Survey respondents | Christchurch residents |
|---|---|---|
| Female | 73% | 52% |
| Male | 26% | 48% |
| Transgender*<br>**not an option in NZ census* | 1% | - |

**Table 1. Gender of survey respondents and Christchurch population**

The following table shows how the age distribution of the survey respondents also differs from the city population. The majority of survey respondents (62%) were aged between 35 and 59, compared to just 36 per cent in this age range among the wider city population, as highlighted in Table 2. These differences can be attributed in part to human ethics requirements for a minimum age of 18 for research participants, and also the composition of the researcher's professional and social spheres (and their networks in turn), which were the targets of repeated requests to complete or share the survey.

| **Age group** | **Survey respondents** (age 18+) | **Christchurch residents** (all ages) |
|---|---|---|
| Under 5 | - | 6% |
| 5-9 | - | 6% |
| 10-14 | - | 7% |
| 15-19* (survey respondents 18-19) | 3% | 7% |
| 20-24 | 8% | 8% |
| 25-29 | 6% | 6% |
| 30-34 | 7% | 7% |
| 35-39 | 14% | 8% |
| 40-44 | 11% | 7% |
| 45-49 | 12% | 7% |
| 50-54 | 12% | 6% |
| 55-59 | 13% | 8% |
| 60-64 | 8% | 4% |
| 65-69 | 3% | 4% |
| 70-74 | 1% | 3% |
| 75-79 | 1% | 3% |
| 80+ | 1% | 4% |

**Table 2. Percentage of survey respondents and Christchurch residents in age groups**

In terms of the ethnicities represented, there is a closer match between the respondent group and the wider city population, as can be seen in the following table. The difference between the percentages of Europeans is likely to be smaller than it first appears, as the public debate about national identity that flared around census time in 2006 was not in evidence at the time of this survey. Research suggests that the majority of those who identified as 'New Zealander' in the 2006 census were of European descent (Cormack and Robson 2010, 5; Kukutai and Didham 2009, 46), which would make the percentage of Europeans in Christchurch in 2006 a lot closer to the figure of 90 per cent recorded in the 2001 census (Statistics NZ 'Tables' n.d.), and the 93 per cent recorded in this survey.

| Ethnicity | Survey respondents | Christchurch residents |
|---|---|---|
| European | 93% | 75% |
| Maori | 7% | 8% |
| Pacific Island | 3% | 3% |
| Asian | 3% | 8% |

| | | |
|---|---|---|
| MELAA *(Middle Eastern, Latin American, African)* | 1% | 1% |
| Other | 1% | 13% |

**Table 3. Ethnicity of survey respondents and Christchurch population**

To enable location-based comparisons, respondents were placed into one of three categories, according to their suburb of residence in February 2011. In recognition that earthquake damage was not contained by simple East/West lines, and that not all eastern suburbs were equally affected, the categorisation of suburban location has been influenced by Hyde's depictions of 'Shower City' and 'Refugee City'. As respondents were not specifically asked about the level of disruption to any services other than electricity, the land zone technical categories assigned by the Canterbury Earthquake Recovery Authority (CERA) have been used as guidance. These technical specifications divided the city's residential Green Zone areas into three sub-categories, based on the land damage already suffered or expected to happen in future earthquakes (CERA 2011, par. 1).

Respondents whose suburbs contained Red Zone land (no longer suitable for occupation) or were mostly zoned TC3 (moderate to significant damage expected in future events) were placed in one group, while those from suburbs consisting mostly of TC1 and TC2 (little to moderate land damage expected in future events) made up another analysis grouping. Those who were not specific enough about their location, were temporarily out of town, or lived in a largely unaffected rural area, were not assigned to either comparative group but their responses have been included in the figures for all respondents.

| **Northwest *(75)*** | | **Northeast *(100)*** | |
|---|---|---|---|
| **TC1-2 *(54)*** | **Red Zone-TC3 *(21)*** | **TC1-2 *(12)*** | **Red Zone-TC3 *(88)*** |
| Avonhead (9) | Fendalton (2) | Linwood (9) | Aranui (6) |
| Bishopdale (7) | Merivale (2) | Mairehau (3) | Avondale (6) |
| Bryndwr (7) | St Albans (17) | | Avonside (17) |
| Burnside (1) | | | Bexley (4) |
| Casebrook (4) | | | Burwood (13) |
| Harewood (2) | | | Dallington (8) |
| Ilam (6) | | | Edgeware (1) |
| Northcote (1) | | | New Brighton (5) |
| Northwood (1) | | | North New Brighton (7) |
| Papanui (7) | | | Parklands (6) |
| Redwood (3) | | | Richmond (10) |
| Russley (4) | | | Shirley (1) |
| Strowan (2) | | | Waimairi Beach (2) |
| | | | Wainoni (2) |
| **Southwest *(54)*** | | **Southeast *(61)*** | |
| **TC1-2 *(54)*** | **Red Zone-TC3 *(0)*** | **TC1-2 *(23)*** | **Red Zone-TC3 *(38)*** |
| Addington (1) | | Beckenham (3) | Heathcote (1) |
| Barrington (1) | | Bromley (2) | Heathcote Valley (2) |
| Cashmere (5) | | Huntsbury (2) | Hillsborough (2) |
| Cracroft (1) | | Phillipstown (5) | McCormacks Bay (1) |
| Halswell (10) | | Waltham (4) | Mt Pleasant (11) |
| Hei Hei (1) | | Woolston (7) | Opawa (1) |
| Hoon Hay (7) | | | Redcliffs (1) |

| | | | |
|---|---|---|---|
| Hoon Hay Valley (1) | | | South New Brighton (5) |
| Hornby (2) | | | Southshore (1) |
| Riccarton (6) | | | St Andrews Hill (1) |
| Sockburn (1) | | | St Martins (8) |
| Somerfield (7) | | | Sumner (4) |
| Spreydon (7) | | | |
| Upper Riccarton (3) | | | |
| Westmorland (1) | | | |
| **Central *(14)*** | | **Outlying suburbs/towns *(12)*** | |
| **TC1-2 *(3)*** | **Red Zone-TC3 *(11)*** | **TC1-2 *(2)*** | **Red Zone-TC3 *(10)*** |
| Sydenham (3) | Avon Loop (1) | Cass Bay (2) | Brooklands (3) |
| | CBD (10) | | Kaiapoi (4) |
| | | | Lyttelton (2) |
| | | | Pines Beach (1) |
| **Other: locations not subject to CERA land zone categories *(19)*** | | | |
| Governors Bay (1) | Hawarden (1) | Kirwee (1) | Leithfield (1) |
| Lincoln (1) | Motukarara (2) | Rangiora (3) | Sefton (2) |
| West Eyreton (1) | West Melton (2) | Woodend (4) | |
| **Other: non-specific location or temporarily out of town *(14)*** | | | |
| Christchurch (11) | Away (3) | | |

**Table 4. Number of respondents in each suburb, sorted by geographic area and land-zone grouping**

Although this categorisation of respondents reflects the relative disruption experienced in different suburbs after the February earthquake, there are limitations in its application. Respondents' location was self-identified, consisting only of the name of a suburb or town, and is unable to be verified. Several suburbs contain both TC2- and TC3-designated land and, although for most suburbs there is a clear majority, there were some suburbs that required a judgement call. For those suburbs with a similar amount of TC2 and TC3 zoning, the classification of surrounding land was also taken into account. For example, some small pockets in the southwest of the city have been designated as TC3 but the majority of residential land in those suburbs is either TC1 or TC2, so there are no south-eastern suburbs included in the Red Zone/TC3 group. However the beachside suburbs of South, Central, and North New Brighton, and Waimairi Beach, have all been included in the Red Zone/TC3 grouping even though they contain a majority of TC2 land. Liquefaction and lateral spreading in nearby Red Zoned land damaged all the bridges that crossed the Avon River and connected the beach suburbs to the rest of the city, cutting off transport routes and damaging the 'lifeline networks' (e.g. power and communications cables) that are carried in pipes beneath the bridges (Palermo et al 2011, 332).

There were more respondents from suburbs assigned to the Red Zone/TC3 group than from those in the TC1-2 group (168 c.f. 148), and more respondents from the eastern suburbs than those in the west (161 c.f. 129). Six of the seven suburbs that recorded ten or more survey responses were from Red Zone/TC3 areas (as highlighted in Table 4), with four of those suburbs being on the eastern side of the city. Halswell (10) and St. Albans (17) were the only two western suburbs to record double-digit responses, but both suburbs do contain some TC3-designated land. The two suburbs with the largest number of responses (17) experienced differing levels of disruption as a result of the February earthquake. While Avonside saw the majority of its neighbourhoods red-

zoned, St. Albans contained a relatively even split of TC2- and TC3-designated land, with no Red Zone areas. Both suburbs however, had pro-active residents' associations and/or locally-focused blogs that were targeted with the survey request email.

## Results

Respondents were asked about their general level of disaster preparedness in terms of personal or household ownership of the following items: an emergency kit, battery-powered radio, analogue landline telephone (i.e. not cordless/digital), and a battery- or dynamo-powered cellphone charger. As can be seen in the following graph, access to the first three items was quite high, with ownership levels above 70 per cent, but only 30 per cent of respondents could charge their mobile phones without access to electricity. There was little difference between the two comparison groups, with ownership of all items being only slightly higher among the Red Zone/TC3 respondents.

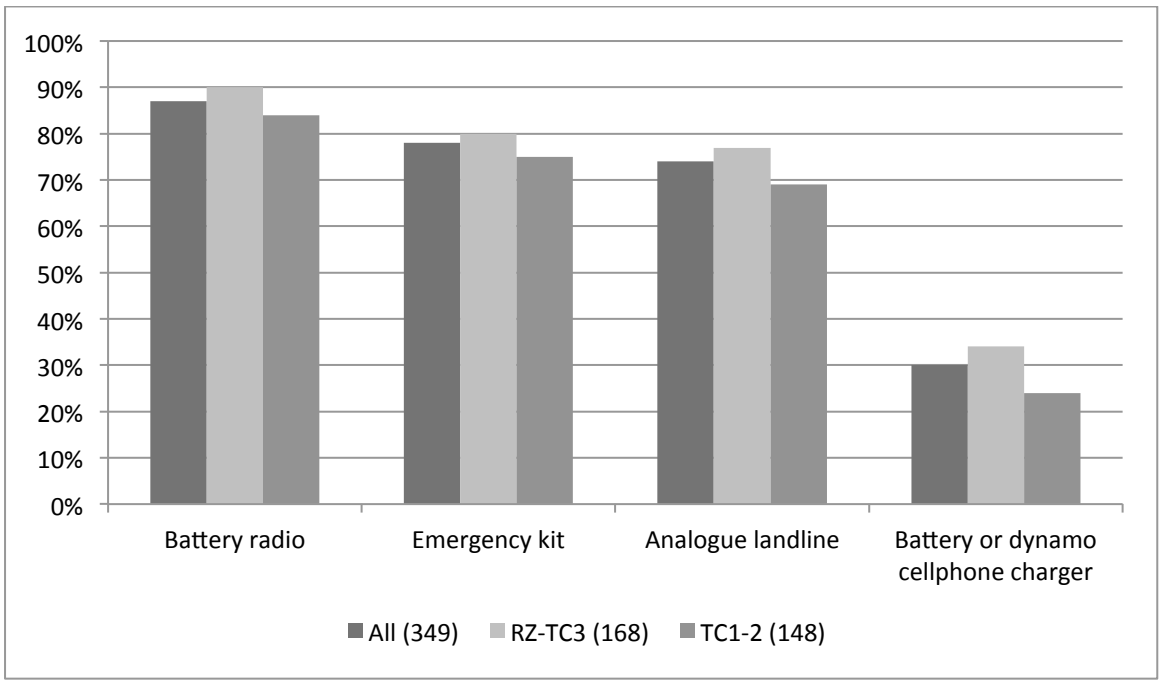


**Figure 1. Ownership of emergency kit and unpowered devices (all respondents vs land zone groupings)**

### Power loss

As discussed, the magnitude 7.1 earthquake of 4 September 2010, was the largest of the entire earthquake sequence, but it was the smaller earthquake (M6.3) of 22 February 2011 that was the most disruptive in terms of damage to buildings, infrastructure, and lives. Survey respondents were asked to indicate how long they were without power (if at all) after the three major earthquake events – 4 September 2010, 22 February 2011, and June 13 2011. There were marked differences in the level and length of disruption between the two land zone groups, which can be seen in the following graph.

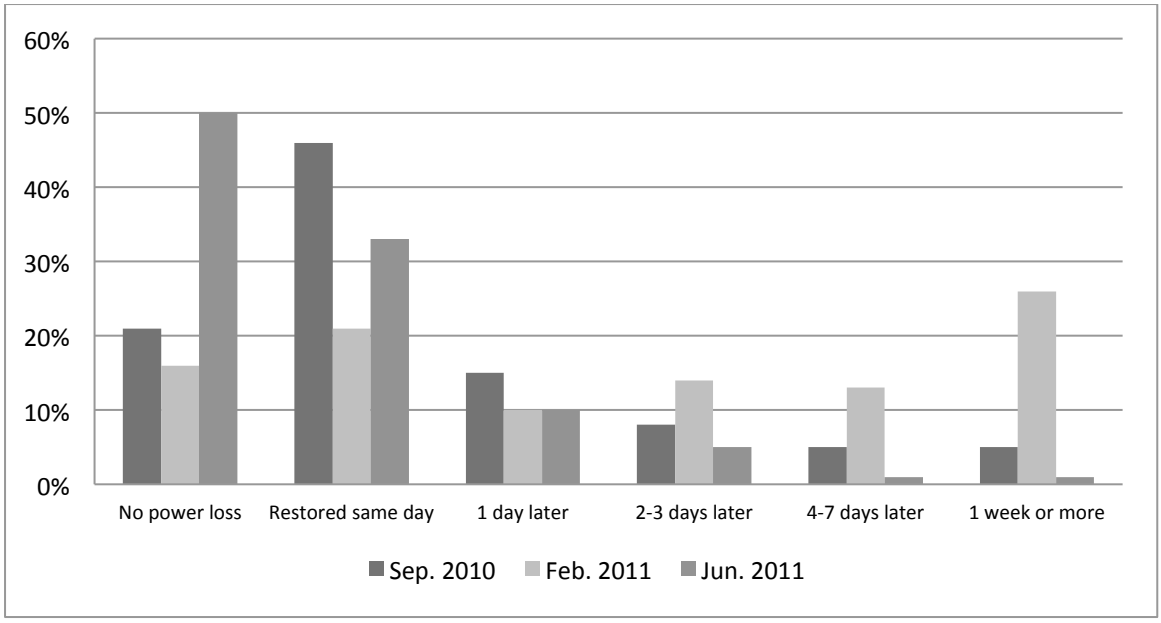


**Figure 2. Time without residential electricity supply after 3 major earthquake events (all respondents)**

Many respondents only experienced a short interruption to their electricity supply after each of these three earthquake events. The majority of respondents who lost power to their home after the very first earthquake in September 2010 reported that it was restored later that same day, and after the June 2011 event, half of all respondents reported no power loss at all. It was a different story in February, when just over a quarter of respondents (26%) were still without power a week or more after the event. The following graph shows the varying lengths of time spent without residential electricity supply, which for some respondents was longer than eight weeks.

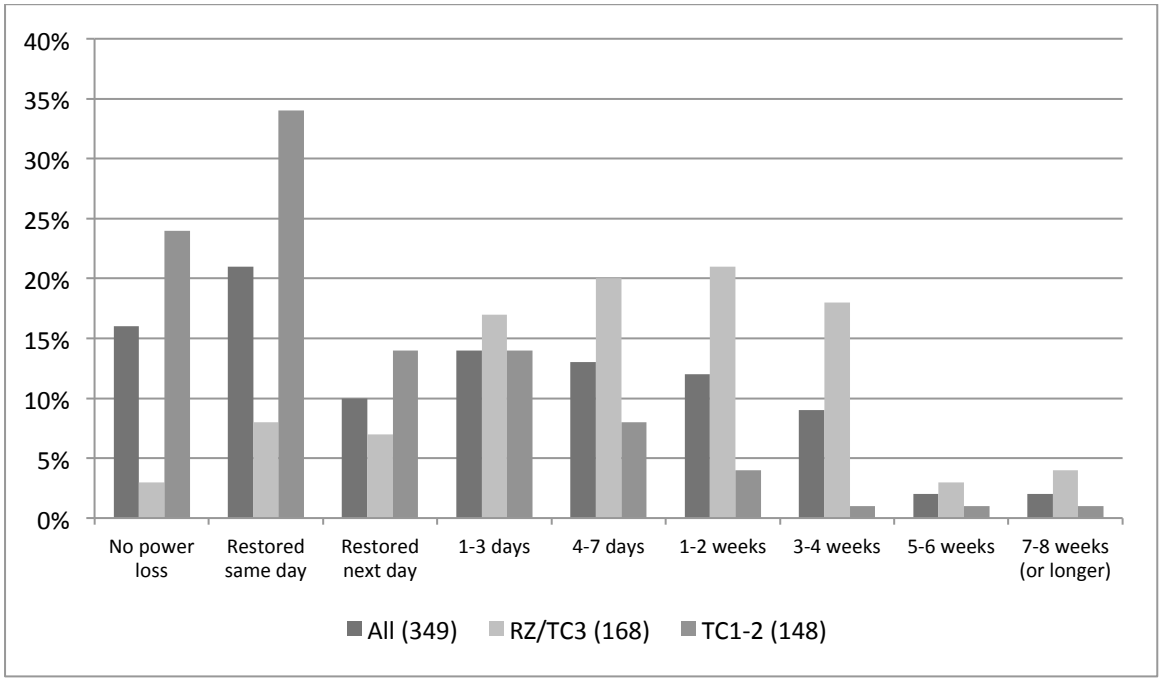


**Figure 3. Length of time without residential electricity supply after Feb 2011 earthquake (all respondents vs land zone groupings)**

The differences between the overall survey figures and the two land zone groupings – the predominantly western TC1-2 group and the predominantly eastern Red Zone/TC3 group – are noticeable. The majority of TC1-2 respondents (63%) either had no interruption to their residential power supply or had it restored the same day, while almost half the Red Zone/TC3 respondents (46%) were without power for over a week. The loss of electricity supply can have a substantial impact on the availability of media and communications technology and, although 47 per cent of all respondents had electricity at home by February 23, this was true for only 18 per cent of the Red Zone/TC3 group compared with 72 per cent of the TC1-2 group.

## Use of media and communications technology

Respondents were asked to indicate which media or methods of communication either failed to work, or were unreliable or intermittent, on 22 February 2011. Mobile phones were problematic for many residents irrespective of location; however, there were items that caused difficulties for more residents in the Red Zone/TC3 group, most notably television, websites, and email, as can be seen in Figure 4.

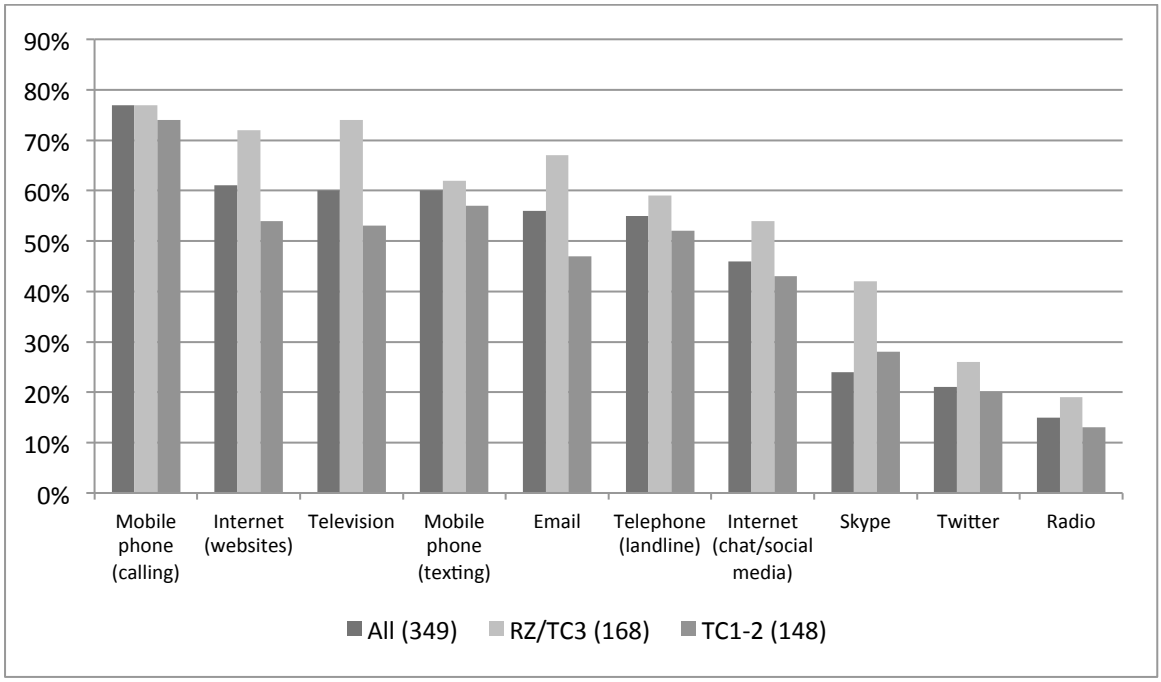


**Figure 4. Unreliable/intermittent communication technologies, 22 Feb 2011 (all respondents vs land zone groupings)**

The land zone groupings are based on residential location and many respondents mentioned they were at work in the central city or other suburbs when the earthquake struck, so location may not be the most stable variable in this case. However, there are still notable differences in the results from the two residential land zone groups for questions about this day, in terms of functionality and usefulness of different media, methods and devices.

After identifying items that didn't work as well as expected, respondents were also asked to indicate which media or methods of communication were helpful or very helpful on 22 February 2011. As shown in the following graph, radio, word of mouth, and text messages sent by mobile phones were considered by many to be helpful. Significantly more respondents from the TC1-2 group rated television as being helpful that day compared to those in the Red Zone/TC3 group (42% c.f. 16%).

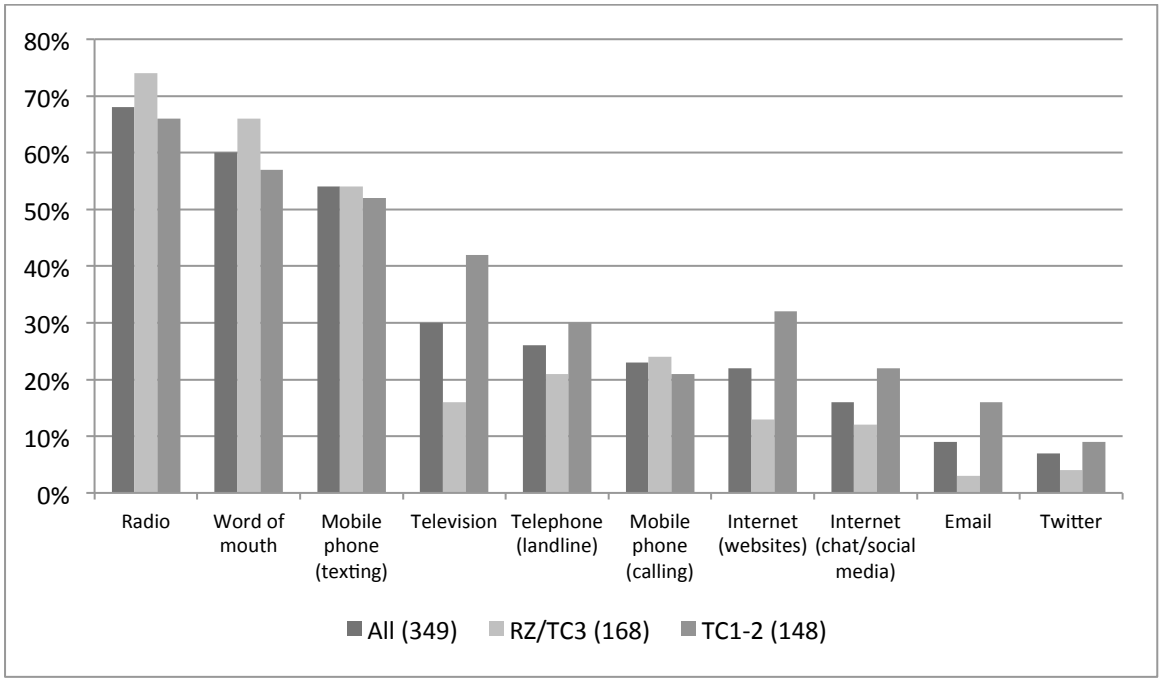


**Figure 5. Helpful communication technologies, 22 Feb 2011 (all respondents vs land zone groupings)**

Email, websites, and chat/social media sites were all considered helpful by approximately twice as many people in the TC1-2 group as in the Red Zone/TC3 group. Twitter was considered helpful or very helpful by only seven per cent of respondents overall, and by twice as many TC1-2 respondents as those in the Red Zone/TC3 suburbs.

Respondents were then asked to consider the days and weeks following the February earthquake and select the three most helpful media types or communication methods for different subject areas. The categories were: casualties and building damage; infrastructure (e.g. road damage/closures and sanitation issues); local services (e.g. public transport and rubbish collection); and keeping in touch with friends and family. For the first three categories, the same communication technologies were consistently rated among the top five, as can be seen in Figures 6-8.

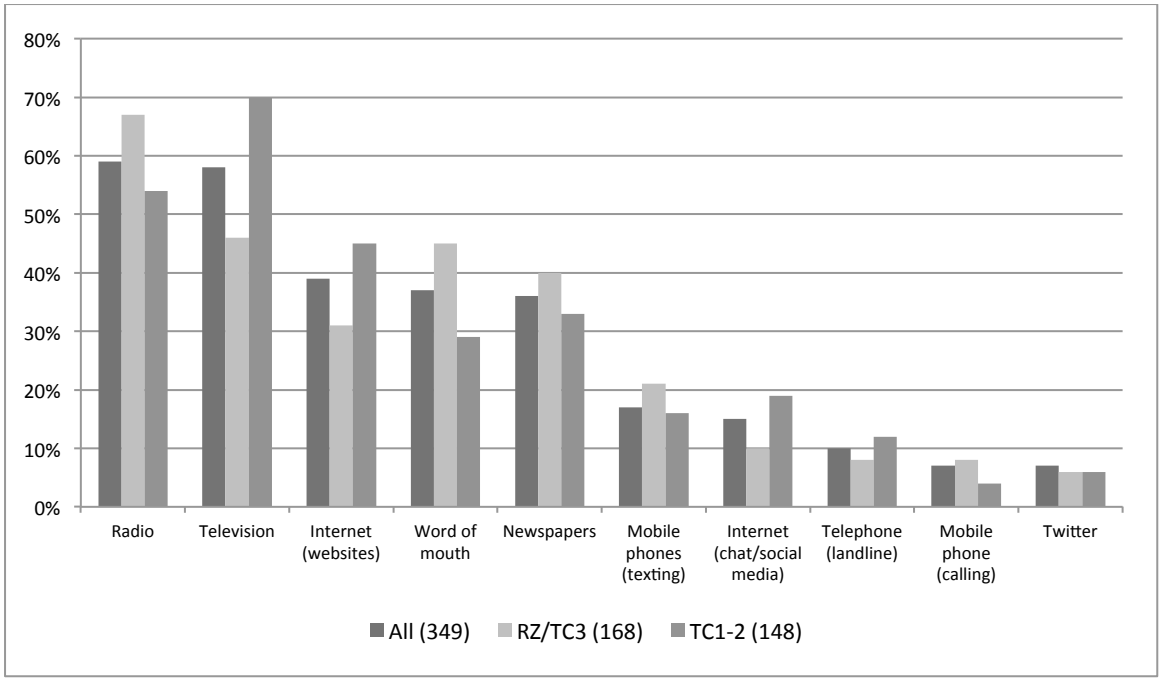


**Figure 6. Most helpful communication technologies for information on casualties and building damage, post-Feb 22 (all respondents vs land zone groupings)**

For information about casualties and building damage, radio and television were rated helpful by a majority of respondents overall. Radio was the most popular medium among the Red Zone/TC3 residents (67%) while television was most popular among TC1-2 residents (70%). Respondents in the Red Zone/TC3 group were more likely to be facing disruptions to electricity supply, which could explain why word-of-mouth was rated as a more helpful information source than internet websites for that group – a situation and result that were reversed in the TC1-2 group.

Damage to roads and sewage pipes were issues for many after the February earthquake, although, as with the disruption to electricity supply, not all respondents and suburbs were equally affected. The following graph shows which media and communication methods were rated most helpful for information about road damage or closure, and sanitation issues such as safe drinking water and toilet use.

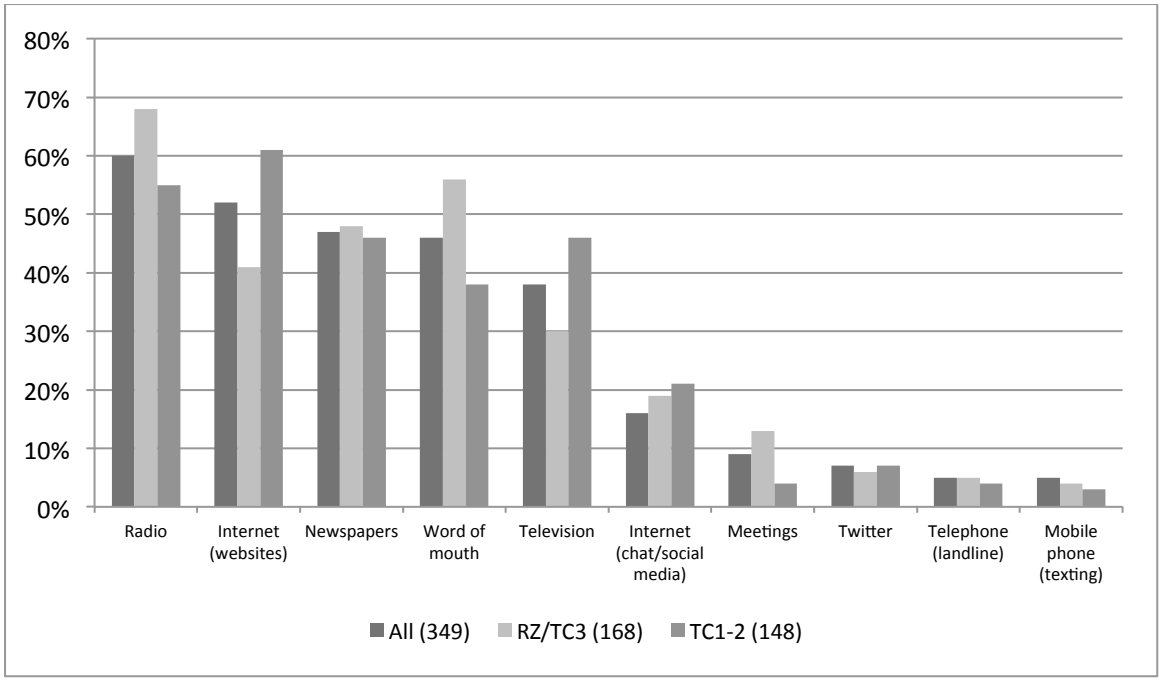


**Figure 7. Most helpful communication technologies for information on road damage and water/sewage, post-Feb 22 (all respondents vs land zone groupings)**

As with the previous subject category, radio was rated as the most helpful overall, and again, by a higher percentage of Red Zone/TC3 respondents (68%) than those in TC1-2 suburbs (55%). Television was not considered as helpful for this type of specific, localised information, trailing behind radio, websites, newspapers and word-of-mouth. Respondents from the TC1-2 group were more likely to rate websites or television as a helpful information source than word-of-mouth, although for Red Zone/TC3 respondents, word-of-mouth was ranked second, ahead of technology-dependent items like websites and television.

Local government services like rubbish collection and public transport may not provide dramatic visuals for television news items but their operation is vital for a functioning city. Finding out when rubbish and recycling services would be resumed, and when or where the buses would be running, were important concerns for many residents.

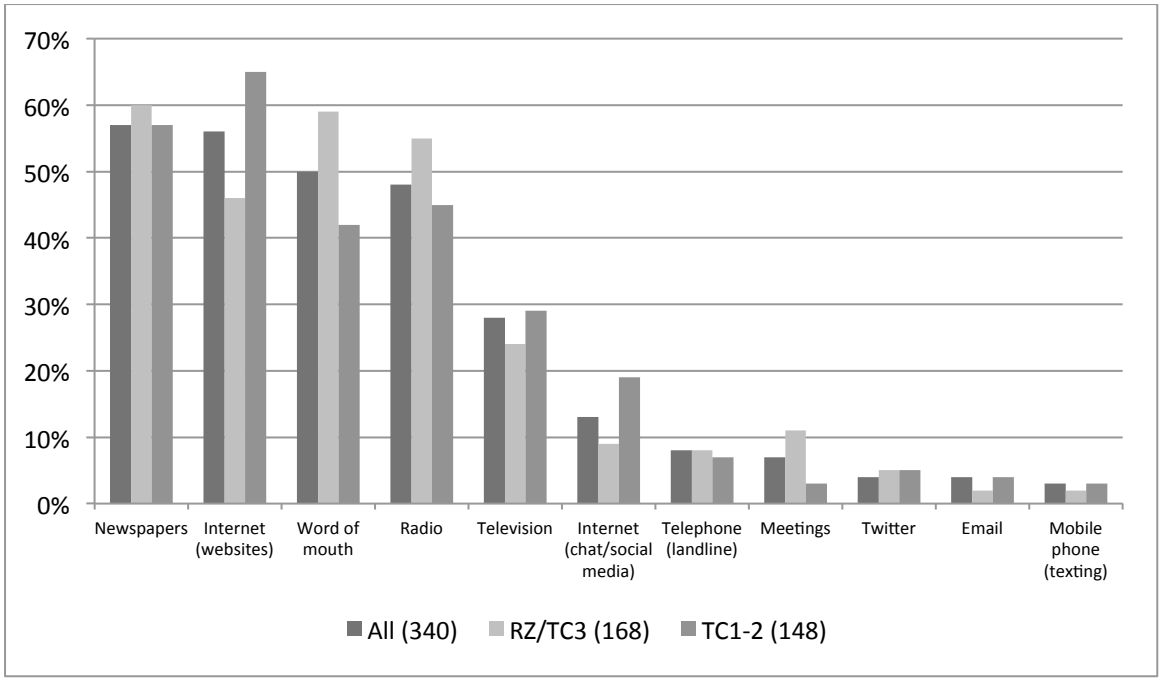


**Figure 8. Most helpful communications technologies for information on local government services e.g. rubbish collection and public transport, post-Feb 22 (all respondents vs land zone groupings)**

As can be seen in Figure 8, local newspapers were considered to be the most helpful overall for finding information on these local government services, with little variation according to location. For TC1-2 respondents it was websites that rated highest (65%), whereas for the Red Zone/TC3 respondents, word of mouth (59%) and radio (55%) were rated almost as highly as newspapers (60%). Television ranked a distant fifth for all respondents, with fewer than 30 per cent rating it as one of the most helpful sources of information in this area.

Over these three subject areas, television was considered useful by many for general, city-wide information about casualties and building damage, but not as useful for more specific, localised information about roads, sanitation, and local services. Respondents in the Red Zone/TC3 group considered radio and word of mouth to be more helpful than those in the TC1-2 group, for whom television and websites featured strongly. Media and communication methods that are not dependent on electricity or internet access (e.g. radio, newspapers, and word of mouth) were the preferred, or perhaps the most functional, methods in the more disrupted suburbs.

The infrastructure disruption experienced in different locations is also reflected in the use of social media as an information source, which generally rated higher among TC1-2 respondents. The usage and perceived helpfulness of Twitter in particular was very low among the respondents, with a maximum of six per cent selecting it as a helpful information source in these areas, with little variance according to location.

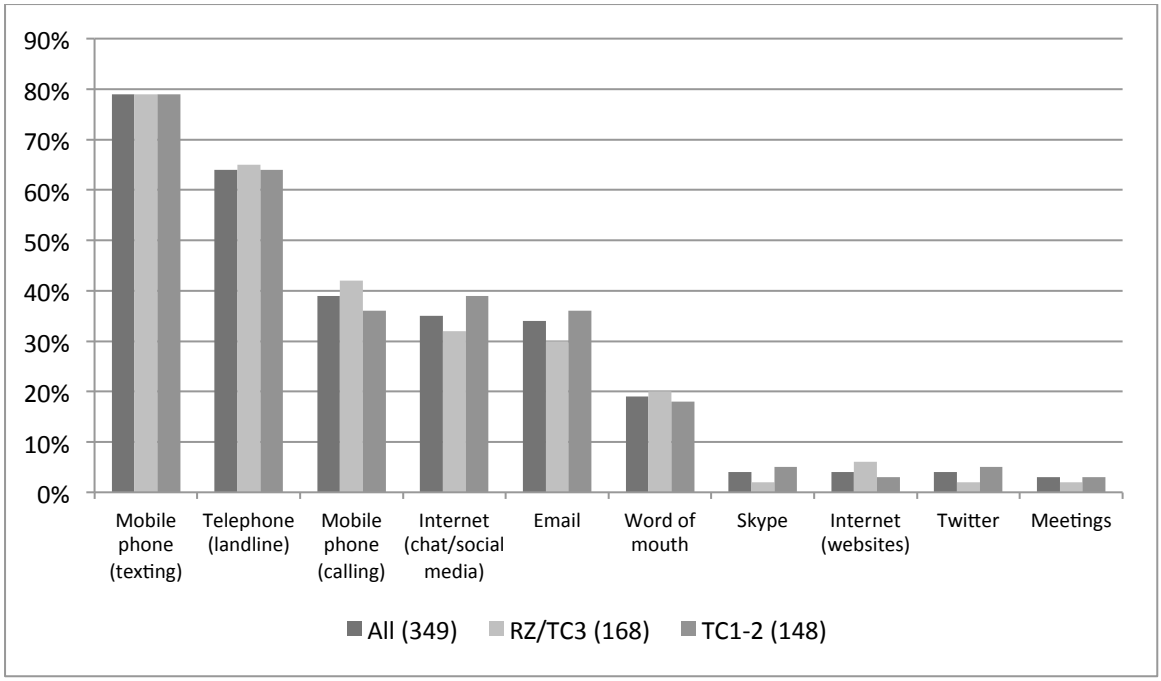


**Figure 9. Most helpful communication technologies for keeping in touch with family and friends, post-Feb 22 (all respondents vs land zone groupings)**

When it came to keeping in touch with friends and family after the February earthquake, a different set of methods were considered helpful by respondents, as shown in Figure 9. For this more direct type of enquiry, there is less variation between the two land zone groupings, with only a slightly higher preference for internet-based communication methods in the TC1-2 group. While telephones were the preferred tools for most, it was the texting function of mobile phones that was rated helpful by almost 80 per cent of respondents. Making calls on landline telephones was considered helpful by a majority of respondents (64%); however, calls made on mobile phones were rated much lower, at a similar level to social media and email. This may be a result of the difficulties encountered with the mobile phone networks, but could also reflect attempts to limit spending or conserve battery power (or both) by texting rather than calling on mobile phones.

The results presented so far show there were notable differences in the use and/or availability of media and technology when comparing the two land zone groups; however, these figures only provide part of the picture. The numerical representation of quantifiable survey data may show *how many* were affected but not *how* they were affected; it can identify malfunctioning devices and networks but not how they were re-routed or bypassed by resourceful individuals; nor can it show how the uneven disruption to infrastructure and technology resulted in the inequitable delivery of information and assistance. To gain an insight into how the information-seeking ability of residents was compromised by earthquake-related damage and the subsequent un-blackboxing of technology and infrastructure, we now turn to the qualitative part of the survey. Responses to the open-entry questions about ongoing or complex issues, like media coverage, the delivery of health and safety information, and neighbourhood

communications, provide rich descriptions of the impact caused by this multi-faceted and unevenly disruptive event.

## Un-blackboxing

It is easy enough to point out examples of technological and infrastructural un-blackboxing that occurred after the earthquake of 22 February, 2011. Items such as televisions and desktop computers do not function without electricity, and batteries in portable devices and cellphone towers will eventually go flat without intervention. The violent movement of the earthquakes laid bare the complex array of components and networks required to keep these objects functioning normally. However it goes beyond a simple lack of function as, even when using other media or restricting battery use, the effects of the disruption may not be taken into account by the media or agencies disseminating information, as these comments show:

> *Radio stations [were useful], however they suggested looking at websites for [water] delivery times and we didn't have power so this was frustrating.*
>
> *Constant advice on radio to download forms and information was USELESS and downright cruel. We had no power for weeks, no telecommunications.*
>
> *Internet and texting are great for getting information out but useless when infrastructure and telecommunications aren't functioning. E.g. the 5,000 tweets sent by Civil Defence were no use to me on my rapidly dying cellphone.*

On 22 February, as thousands of people tried to call or text at the same time, the existence and limitations of the infrastructure supporting the cellular phone network became apparent through failure and congestion. Many respondents reported having issues with cellphone communications however some found ways to work around the disruption and successfully made contact with loved ones:

> *Although my daughter who lives in Sumner was receiving our texts & voice messages she was unable to respond to us. My husband's cousin called us from San Francisco. We told her we were worried about our daughter. She's a doctor & she called the NZ Police on the international [doctors] communication line. The Police called me at 11pm on 22/2 for details and again at 6am next morning to tell me that our daughter & family were OK.*
>
> *I found that on February 22nd my best means of communication was to talk with my daughter who lives in Melbourne on my cell phone. She then rang other family members to check on them and rang me back to let me know how they were. Texting was erratic.*

But there were other, unexpected ways in which previously blackboxed infrastructure or networks became exposed to the public gaze. That the majority of New Zealand's free-to-air broadcasting networks are presented to a national audience is not normally of concern to most people, until one regional market suddenly has very different

information needs to the rest of the nation. Respondents described a perceived mismatch between the desire of radio and television networks to retain and entertain the national audience, and the detailed and specific information needed by Christchurch residents:

> *The channels tried to maximise the visual impact for a predominantly external audience while those 'inside' the situation needed to know details – does anyone know the state of affairs in our street/suburb/area, what roads are safe, where is the petrol and water…*
>
> *With everything being national now it highlights the problems there are with the stations, both radio and TV trying to keep up ratings and make the news sensation[al] to all… making it very difficult if you are actually isolated in the middle of the situation to find out any information you actually need.*

Newspapers were considered by many respondents to be a good source of information about local conditions and services, and the traditional print version is not dependent on electricity for consumption. However the damage caused by the earthquake exposed the frailties and interdependence of the distribution and e-commerce networks that are an essential part of the newspaper purchasing process, as this respondent explains:

> *[It was] hard to even buy a newspaper… supermarkets and garages closed, local dairy [was accepting] cash only as no eft-pos, no electricity.*

It is true that most of the disruption to homes, electricity supply and suburban retail services was in the eastern suburbs. Many respondents felt the reality of their individual situation differed from the broad brush strokes being painted by the media and were critical of the amount and type of media coverage given to 'the East', albeit for quite different reasons:

> *I think there has been too much focus on the 'eastern suburbs' i.e. Bexley, Aranui etc. While they have definitely endured a lot I think it is unfair to portray [Christchurch] as a city of two halves. I know a lot of people in Fendalton, Merivale etc who have had serious ongoing damage to their properties, many grand old character homes have been demolished in that part of town…*
>
> *The media portrayed the East as almost the only area hit, and also, that it was all lower socio-economic households… there were many expensive 'flash' houses in the East as well which are now red zoned.*
>
> *Perhaps [seeing] the same scene of destruction each night on the news gave [tourists] the sense that all of Christchurch was destroyed. That has led to confusion for people travelling here who might only see the western side and wonder what all the fuss is about or why things look so normal.*

Although there is ample evidence to support the claim that Christchurch was a 'city of two halves', it was certainly not an even split nor a straight East/West divide. Neat

patterns and tidy categories are not a good fit with the very messy reality of life in a disaster zone. It is true that a lack of functional infrastructure has a direct impact on people's media use and communication methods during disaster, but focussing on the tools alone provides a surface-level reading of the situation. While life was beginning to return to a semblance of 'normal' for some residents, others were still waiting for the restoration of basic services.

Several respondents commended the CCC for their use of social media, but those who could not access these platforms, or indeed any kind of telecommunications, felt that resources were going to those who yelled loudest, regardless of actual need. This frustration was particularly evident when it came to sanitation and sewage issues, which were often much worse in Red Zone/TC3 areas:

> *It was very upsetting to go over to the other side of town about a week after the quake and find portaloos spread very evenly along the streets, when there were NO portaloos on the hardest hit eastern side of town! We then found out that you had to ring up – but many people were without power, phones etc.*
>
> *It ended up favouring [people in] the wealthier less damaged suburbs who could use their phones and internet to contact CCC and get a portaloo just in case they might need it while over here we couldn't reach anyone at CCC and were told it was our own fault for not emailing or ringing in.*

When asked how they found out where drinking water was available, many Red Zone/TC3 respondents said it was either through word of mouth or the act of discovery (i.e. walking, cycling, or driving past a supply point). Radio and newspapers were popular sources among both groups however television was three times more popular among TC1-2 respondents. Six times as many respondents in the Red Zone/TC3 group reported finding water thanks to printed or handmade signs on fences and lampposts. This says as much about what methods are preferred or available as it does about the type and urgency of information needed: those in the Red Zone/TC3 group were more likely to be actively seeking specific water sources, while residents in the TC1-2 suburbs often had no need to look beyond the generalised information provided in television news reports. Priorities, as well as available options, can be very different depending on location and the level of disruption.

## Social media and the Internet

When looking at differences in media use and communication methods in different parts of the city, it is not just a simple matter of electricity being on or off, but rather a complex relationship involving location, disruption, and information needs. The use of social media and the Internet during disaster will always rely on a combination of interest and accessibility. Many respondents experienced difficulties because of an over-reliance on electronic communications by authorities and organisations who appeared to assume an ease or level of access not available to all:

> *If you are in an area with no power for several weeks, with bad roads and your immediate day to day business is sorting out water and toilet facilities, plus cooking without power, it is very difficult to look on a website… Being without power cuts you off from a lot of things.*
>
> *Eastern side of [the] city needed printed notices placed around the area. All the information at www. was useless.*
>
> *Civil Defence and CCC put out texts and notices on power poles and in newspapers telling us to call the earthquake phone number or go to the website, but no-one had phone or power or internet, this really annoyed a lot of people, they didn't seem to have any understanding of the issues we faced…*
>
> *There was too much reliance on electronic communications. No point tweeting that details are available on a particular website when the bulk of the population don't know what Twitter is, and can't access the internet due to power and telephone failures.*

While it is impossible to know whether 'the bulk of the population' know what Twitter is, it has been ascertained that only a small minority of the New Zealand population actually use the platform. Throughout this survey, Twitter generally recorded between seven and ten per cent of responses to any question, which is on a par with the level of Twitter usage (7% of the population) in New Zealand at the time (Friedlieb 2012). However, those respondents who did utilise the platform for communication or information-seeking were quite enthusiastic about its usefulness:

> *Twitter has been fascinating to watch as it grows in immediate emergency information and high speed sharing.*
>
> *I think Twitter is genius and found it super helpful.*
>
> *I found Twitter was remarkably useful for crowd-sourcing more minor things such as which shops were open which, while not essential to survival, made life a lot easier. Twitter was also the way most friends 'checked in' after the major quakes…*

There was never much variation in use and/or perception of Twitter between the two comparative groups, suggesting that interest and aptitude were bigger influences than suburban location or level of disruption. This is supported by recent nationwide research which shows that differences in online media activities are more dependent on age, lifestage, and access to technology than location (Colmar Brunton 2014, 15). There is a characteristic enthusiasm exhibited by Twitter users (and other technological cliques) that can colour their perception of the medium's importance (Manhire 2012) in both daily life and during disaster. Although growing in numbers, Twitter has not yet expanded beyond a relatively small but dedicated user-base in New Zealand.

## Conclusion

The extended series of seismic events experienced by Cantabrians from 2010 to 2011 is similar to other recent disasters in that research and commentary about the use of new technologies is plentiful. However, this research shows that traditional media such as radio, television, and newspapers have important roles to play for residents during and after disaster. Radio and print media in particular can be crucial in disaster-affected areas when essential infrastructure, like electricity and telecommunications networks, are damaged. However even media networks are vulnerable to the process of un-blackboxing that is normally associated with technological gadgets and city infrastructure, as distribution options and audience needs may suddenly differ – not only from the status quo but also from one suburb to another.

The socio-geographic divisions depicted by Hyde – Rescue City, Shower City, and Refugee City – provided the impetus for the categorisation of survey respondents into land zone categories. By using the CERA land zones as indicators of suburban disruption, this research has compared groups of survey respondents and found there was a higher use and more positive perception of electronic and internet-based technologies in the less-disrupted parts of the city. Residents in areas that were classified as Red Zone or TC3 were more likely to be without power immediately after the February earthquake which contributed to a heavier use of radio, print, and word of mouth. The scope and duration of disruption varied across the city, which lead to differences not only in the use and availability of media and communication methods, but also in the type and urgency of information being sought.

This research has explored how location can impact on the perception and use of media and communication technologies during disaster. This is an issue that goes beyond the lack of residential electricity supply and the disruption of urban infrastructure, as it is not only technology that is vulnerable to the process of blackboxing. Those who experienced the very worst effects of this disaster will have a very different perspective on the disruption than those from other parts of the city, or even further afield. Within the disaster zone itself, the process of un-blackboxing was evident in many different ways – from malfunctioning cellular phones and communication networks to national media programming that resulted in a lack of easily accessible, localised information. Distance masks difference, and when time is also added to the equation, the process of blackboxing comes back into play. What was actually a messy and complex series of seismic events that resulted in uneven levels of destruction and disruption has been rendered by time and distance into a single earthquake with a uniformly disastrous result.

Social media has certainly proved to be useful after disaster but not universally so, even for people and organisations that use these platforms regularly. The increasing amount of research into the use of social media to communicate about crisis does not necessarily correlate to a parallel increase in its use by those who experience a crisis first-hand. Social media and internet-based applications may well provide shiny,

attractive additions to the tapestry of communication but they are only small pieces of the patchwork. When examining them as part of the wider media ecology, it is clear that new technologies are only of interest to some, and during disaster they become inaccessible to many as the threads of infrastructure holding them in place break under stress. Internet-based technology and information may enable worldwide participation in crisis communication, but localised disruption can make access to these conversations difficult or even impossible.

## References

Anderson, Vicki. 2011. 'Living in Middle Eastern Christchurch.' *Rock and Roll Mother*, March 3. Accessed March 15, 2014. http://www.stuff.co.nz/the-press/opinion/blogs/rock-and-roll-mother/4726836/Vicki-Anderson-Living-in-middle-eastern-Christchurch.

Austrin, Terry and John Farnsworth. 2012. 'Upheaval: Seismic, Social and Media Mash-ups After the Christchurch Earthquakes.' *New Zealand Journal of Media Studies* 13.2:78-94. Accessed 10 March 2014.

Bruns, Axel, and Jean Burgess. 2012. 'Local and Global Response to Disaster: #eqnz and the Christchurch Earthquake.' Paper presented at Australian and New Zealand Disaster and Emergency Management Conference, Brisbane, Australia, April 16-18. Accessed 14 February 2014. http://eprints.qut.edu.au/50739.

Carey, John. 2002. 'Media Use During a Crisis.' *Prometheus* 20.3:201-207.

CERA. 2011. 'Overview of TC1, TC2 and TC3 Technical Categories.' Accessed 15 March 2014. http://cera.govt.nz/residential-green-zone-technical-categories/overview.

Chhetri, Prativa, and Sandhya Narayan. 2010. 'Engendered disaster management through community radio.' *Women in Action* 2010-1:16-19. Accessed 14 August 2011. http://www.isiswomen.org/index.php/movement-building/womeninactionwia?id=1472.

Colmar Brunton. 2014. 'Where are the Audiences? Benchmark Survey of New Zealanders' Media Consumption.' Accessed 25 July 2014. http://www.nzonair.govt.nz/research/all-research/where-are-the-audiences/.

Consedine, Jim. 2012. 'A Tale of Two Cities.' *Catholic Worker*. Accessed 10 March 2104. http://www.catholicworker.org.nz/cg/CG62-ATaleOfTwoCities-ConsedineJ.html.

Cormack, Donna, and Casey Robson. 2010. 'Ethnicity, National Identity and 'New Zealanders': Considerations for Maori Health and Ethnic Inequalities.' *Ethnicity Data in Aotearoa/New Zealand*, 15 September. http://www.ethnicity.maori.nz/files/ethnicity_national_identity.pdf.

Edwards, Bryce. 2011. 'NZ Politics Daily – 3 March.' *Liberation*, March 3. Accessed 10 March 2014. http://liberation.typepad.com/liberation/2011/03/nz-politics-daily-3-march.html.

Enander, Ann and Claes Wallenius. 1999. 'Psychological Reactions and Experiences Among Swedish Citizens Resident in Kobe During the 1995 Earthquake.' *International Journal of Mass Emergencies and Disasters* 17.2:185-205

Falkheimer, Jesper and Mats Heide. 2006. 'Multicultural Crisis Communication: Towards a Social Constructionist Perspective.' *Journal of Contingencies and Crisis Management* 14.4:180-189.

Fischer, Henry. 2003. 'The Sociology of Disaster: Definitions, Research Questions, and Measurements Continuation of the Discussion in a Post-September 11 Environment.' *International Journal of Mass Emergencies and Disasters* 21.1:91-107.

Fordham, Maureen. 1999. 'The Intersection of Gender and Social Class in Disaster: Balancing Resilience and Vulnerability.' *International Journal of Mass Emergencies and Disasters* 17.2:15-36.

Friedlieb, Nicola. 2012. 'Social Media Statistics September 2012, Australia & New Zealand.' *Adcorp*, October 2. Accessed 25 June 2014. http://www.adcorp.co.nz/news-blog/social-media-statistics-september-2012,-australia.

Garnett, James, and Alexander Kouzmin. 2007. 'Communicating throughout Katrina: Competing and Complementary Conceptual Lenses on Crisis Communication.' *Public Administration Review* 67, Issue Supplement S1:171-188.

Gaudin, Sharon. 2013. 'Google Launches Person Finder, Map for Typhoon Haiyan.' *Computer World*, November 11. Accessed 10 March 2014. http://www.computerworld.com/s/article/9243948/Google_launches_Person_Finder_map_for_Typhoon_Haiyan.

Graham, Stephen. 2012. 'Disrupted Cities: Infrastructure Disruptions as the Achilles Heel of Urbanized Societies.' *Disaster, Infrastructure and Society: Learning from the 2011 Earthquake in Japan* 3:12-26.

Hansen, Kristi. 2011. 'The Role of Social Media in Crisis Communication.' *GottaQuirk*, March 8. Accessed 15 February 2014. http://www.gottaquirk.com/2011/03/08/interview-christchurch-quake-survivor/.

Hayden, Thomas. 2011. 'Christchurch, Hardtack and the Myth of Earthquake Preparedness.' *Last Word on Nothing*, 10 March. Accessed 10 March 2014. http://www.lastwordonnothing.com/2011/03/10/christchurch-hardtack-and-the-myth-of-earthquake-preparedness/.

Hyde, Peter. 2011. 'Christchurch Quake – More Action Needed in Eastern Suburbs Right Now.' *Webcentre.co.nz*, March 2. Accessed 17 March 2014. http://webcentre.co.nz/quake/originalcall.htm.

Jefferson, Theresa, L. 2006. 'Using the Internet to Communicate During a Crisis.' *The Journal of Information and Knowledge Management Systems* 36.2:139-142. Accessed 15 August 2011. Doi:10.1108/03055720610682933.

Kukutai, Tahu and Robert Didham. 2009. 'In Search of Ethnic New Zealanders: National Naming in the 2006 Census.' *Social Policy Journal of New Zealand* 36:46-62.

Latour, Bruno. 2005. *Reassembling the Social: An Introduction to Actor-Network Theory*. Oxford: Oxford University.

Law, John. 1992. 'Notes on the Theory of the Actor-Network: Ordering, Strategy, and Heterogeneity.' *Systems Practice* 5.4:379-93.

Lew. 2011. 'The Three Cities of Christchurch.' *Kiwi Politico*, March 2. Accessed 15 March 2014. http://www.kiwipolitico.com/2011/03/the-three-cities-of-christchurch/.

MacArthur, Amanda. No date. 'The Real History of Twitter, In Brief.' *About.com*. Accessed June 12, 2014. http://twitter.about.com/od/Twitter-Basics/a/The-Real-History-Of-Twitter-In-Brief.htm

Macias, Wendy, Karen Hilyard, and Vicki Freimuth. 2009. 'Blog Functions as Risk and Crisis Communication During Hurricane Katrina.' *Journal of Computer-Mediated Communication* 15:1-31.

MacManus, Richard. 2011. '#EQNZ: Social Media Response to the Christchurch Earthquake.' *ReadWrite*, February 27. Accessed 14 February 2014. http://readwrite.com/2011/02/27/eqnz_social_media_response_to_the_christchurch_ear#awesm=~ovOO4T8mBSkT28.

Manhire, Toby. 2012. 'Survey: more New Zealanders use Google+ than Twitter.' *The Listener*, October 23. Accessed 25 June 2014. http://www.listener.co.nz/commentary/the-internaut/survey-more-new-zealanders-use-google-than-twitter/.

McCrone, John. 2013. 'Players at the Helm of a Boom.' *Christchurch Press*, May 11. Accessed 10 March 2014. http://www.stuff.co.nz/the-press/business/the-rebuild/8660409/Players-at-the-helm-of-a-boom.

McCue, T.J. 2013. 'Google Person Finder Helps in Boston Marathon Explosions.' *Forbes*, April 15. Accessed 10 March 2014. http://www.forbes.com/sites/tjmccue/2013/04/15/google-person-finder-helps-in-boston-marathon-explosions/.

McIvor, Kerre. 2011. 'Rugby is the Least of Christchurch's Worries.' *New Zealand Herald*, March 20. Accessed 15 March 2014. http://www.nzherald.co.nz/opinion/news/article.cfm?c_id=466&objectid=10713673.

Metal, Steff. 2011. 'On Social Media's Use (and Misuse) After the Christchurch Earthquake.' *Waxing UnLyrical*, March 7. Accessed 14 February 2014. http://waxingunlyrical.com/2011/03/07/on-social-medias-use-and-misuse-after-the-christchurch-earthquake/.

Murray, James. 2011. 'Twitter Trends Map Taken Over by Christchurch Earthquake.' *3News*, February 22. Accessed 15 February 2014. http://www.3news.co.nz/Twitter-trends-map-taken-over-by-Christchurch-earthquake/tabid/423/articleID/199349/Default.aspx.

Neal, David. 1997. 'Reconsidering the Phases of Disaster.' *International Journal of Mass Emergencies and Disasters* 15:239-264.

Nelson, Anne, and Ivan Sigal. 2011. *'Lessons From Haiti: Media, Information Systems and Communities'*. Accessed 15 August 2011. http://www.knightfoundation.org/publications/media-information-system-and-communities-lessons-h.

Olofsson, Anna. 2007. 'The Preparedness of Local Authorities for Crisis Communication with People who have Foreign Backgrounds – The Case of Sweden.' *International Journal of Mass Emergencies and Disasters* 25.2:145-173.

Palen, Leysia, Sarah Vieweg, Sophia B. Liu, and Amanda Lee Hughes. 2009. 'Crisis in a Networked World: Features of Computer-Mediated Communication in the Virginia Tech Event.' *Social Science Computer Review* 27:467-480. Accessed 15 August 2011. Doi:10.1177/0894439309332302.

Palermo, Alessandro, Liam Wotherspoon, John Wood, Howard Chapman, Allan Scott, Lucas Hogan, Anton Kivell, Elena Camnasio, Mark Yashinsky, Michael Bruneau, and Nawawi Chouw. 2011. 'Lessons Learnt From 2011 Christchurch Earthquakes: Analysis and Assessment of Bridges.' *Bulletin of the New Zealand Society for Earthquake Engineering* 44.4:319-333.

Pipes, Tisha, and Jarrod Knudson. 2006. 'Katrina Bankrupts the Information-Rich: Information Poverty in Slidell, Louisiana.' *Learning from Catastrophe: Quick Response Research in the Wake of Hurricane Katrina*. 403-428. Boulder: Natural Hazards Center, University of Colorado.

Piotrowski, Chris, and Terry Armstrong. 1998. 'Mass Media Preferences in Disaster: A Study of Hurricane Danny.' *Social Behavior and Personality* 26.4:341-346.

''Refugee City' being neglected – blogger.' 2011. *New Zealand Herald*, 2 March. Accessed 17 March 2014. http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=10709753.

Sakaki, Takeshi, Makato Okazaki, and Yutaka Matsuo. 2010. 'Earthquake Shakes Twitter Users: Real-time Event Detection by Social Sensors.' Paper presented at WWW2010 conference, Raleigh Convention Center, North Carolina, April 26-30.

Schiller, Kurt. 2011. 'Disaster Response: Technology Makes a Difference.' *Information Today*, May. Accessed 22 August 2011. . http://www.infotoday.com/it/may11/Schiller-Disaster-Response.shtml.

Smith, Craig. 2014. 'By the Numbers: 215 Amazing Twitter Statistics.' *Digital Marketing Ramblings*. Accessed 12 June 2014. http://expandedramblings.com/index.php/march-2013-by-the-numbers-a-few-amazing-twitter-stats/#.U_A6RmOTDRM.

Spence, Patric, Kenneth Lachlan, Donyale Griffin. 2007. 'Crisis Communication, Race, and Natural Disasters.' *Journal of Black Studies* 37:539-554.

Statistics New Zealand. No date. '2013 Census Regional Summary Tables – Parts 1 and 2.' Accessed 1 April 2014. http://www.stats.govt.nz/Census/2013-census/data-tables/regional-summary-tables-part-1.aspx.

---. No date. 'Household Use of Information and Communication Technology: 2012.' Accessed 16 February 2014.

http://www.stats.govt.nz/browse_for_stats/industry_sectors/information_technology_and_communications/HouseholdUseofICT_HOTP2012/Commentary.aspx.

---. No date. 'Tables About Christchurch City.' Accessed 28 December 2013. http://www.stats.govt.nz/Census/2006CensusHomePage/Tables/AboutAPlace/SnapShot.aspx?ParentID=&type=&tab=Culturaldiversity&id=2000060.

Sutton, Jeannette. 2012. 'When Online is Off: Public Communications Following the February 2011 Christchurch, NZ, Earthquake.' Paper presented at the 9th International Information Systems for Crisis Response and Management Conference, Vancouver, Canada, April 22-25. Accessed 15 February 2014. www.iscramlive.org/ISCRAM2012/proceedings/227.pdf.

Walls, Alex. 2011. 'Social Media Steps Up in Quake Recovery.' *National Business Review*, February 23. 2011. Accessed 14 February 2014. http://www.nbr.co.nz/article/social-media-steps-quake-recovery-aw-86739.

Yeomans, Matthew. 2012. 'Social Media's Crucial Role in Disaster Relief Efforts.' *The Guardian*, November 6. Accessed 15 February 2014. http://www.theguardian.com/sustainable-business/social-media-hurricane-sandy-emergency-planners.